The Apple IIc

Apple IIc Imagewriter User's Manual



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The Imagewriter Tool Kit uses a machine language interface, and incorporates modules from "The Routine Machine" written by Peter Meyer and published by Roger Wagner Publishing.

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Warning

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and TV reception.



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Radio Frequency Interference Statement

The equipment described in this manual generates and uses radio-frequency energy. If it is not installed and used properly, that is, in strict accordance with our instructions, it may cause interference with radio and television reception.

This equipment has been tested and complies with the limits for a Class B computing device in accordance with the specifications in Subpart J, Part 15, of FCC rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that the interference will not occur in a particular installation, especially if you use a "rabbit ear" television antenna. (A "rabbit ear" antenna is the telescoping-rod type usually contained on TV receivers.)

You can determine whether your computer is causing interference by turning it off. If the interference stops, it was probably caused by the computer or its peripheral devices. To further isolate the problem:

- Disconnect the peripheral devices and their input/output cables one at a time. If the interference stops, it is caused by either the peripheral device or its I/O cable. These devices usually require shielded I/O cables. For Apple peripheral devices, you can obtain the proper shielded cable from your dealer. For non-Apple peripheral devices, contact the manufacturer or dealer for assistance.

If your computer does cause interference to radio or television reception, you can try to correct the interference by using one or more of the following measures:

- Turn the TV or radio antenna until the interference stops.
- Move the computer to one side or the other of the TV or radio.
- Move the computer farther away from the TV or radio.
- Plug the computer into an outlet that is on a different circuit than the TV or radio. (That is, make certain the computer and the radio or television set are on circuits controlled by different circuit breakers or fuses.)
- Consider installing a rooftop television antenna with coaxial cable lead-in between the antenna and TV.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet, prepared by the Federal Communications Commission:

"How to Identify and Resolve Radio-TV Interference Problems"
This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, stock number 004-000-00345-4.

About This Manual

Welcome to the Imagewriter manual for the Apple® IIc Personal Computer. To make it easier to use, this manual is divided into two distinct parts, Part I and Part II. Part I pages have a red edge, and Part II pages have a gray edge.

Part I is for everyone. Part II is for experienced users.

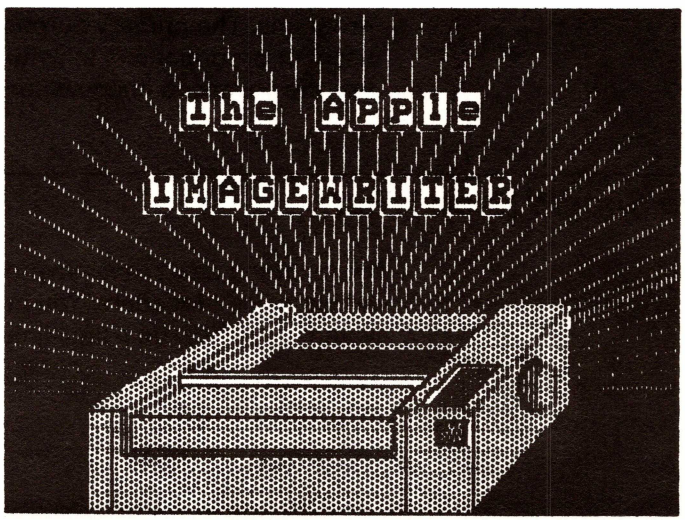
Part I: User's Guide, is the only part of the manual that most users will need. Part I provides all the information you need to set up your Imagewriter and start printing.

Part II: Reference, contains a great deal of reference material for the experienced user or programmer who may need to write or modify programs in order to take advantage of some of the advanced features of the Imagewriter. Either the Table of Contents or the Index provides you with a quick means of locating desired information in Part II.

What Your Imagewriter Can Do

You can print both words and graphics.

Your Imagewriter can print anything a typewriter can, and more. Given the proper commands, it can underline text, print in boldface, output graphics, or mix more than one typeface in a given document.



How To Use This Manual

The following is a brief outline of the contents of this manual:

Part I: User's Guide

- For a description of Imagewriter controls and parts, read Chapter 1.
- Follow the instructions in Chapter 2 to load paper and ribbon, to run a built-in test on the Imagewriter, and to connect it to your Apple IIc.
- In Chapter 3 you start printing and check your setup.
- Chapter 4 demonstrates the graphics capabilities of your Imagewriter.
- Chapter 5 gives you helpful suggestions for keeping your Imagewriter in good working order.

Part II: Reference

- Chapter 1 provides some examples of printing with Applesoft and Pascal.
- Chapter 2 describes the use of the Imagewriter Tool Kit.
- Chapters 3 and 4 describe Imagewriter control codes.
- Appendix A gives troubleshooting suggestions, and Appendixes B through F provide additional program and firmware information.

Part II, Reference, is not needed for running pre-packaged programs. The primary purpose of Part II is to aid experienced users or programmers in writing or modifying programs that use the advanced Imagewriter features.

Who Should Read What

The following chart recommends chapters and appendixes for various types of readers. You may be a combination of types (for example, you may be a first-time user setting up your own system).

	PART I USER'S GUIDE					PART II REFERENCE									
	Chapters					Chapters				Appendixes					
READER	1	2	3	4	5	1	2	3	4	A	B	C	D	E	F
Person setting up the system	●	●	●							●					
First-time user wanting to use already connected system with pre-packaged programs	●		●		●										
Experienced Apple computer user	●	●	●	●	●	●	●	●		●	●			●	●
Programmer	●	●	●			●	●	●	●		●	●	●		

Aids to Understanding

Look for these visual aids throughout the manual:

By The Way: Gray boxes contain sidelights or interesting pieces of information. Read the boldface tag to decide if you want to read the box.

Important! Gray boxes like this contain important information.



Warning
Warning boxes like this direct your attention to something that could damage either software or hardware. They also are used to alert you to important safety precautions.

Look for helpful notes in the margins.

FYI means *for your information.*

Marginal notes are used occasionally to summarize the main point of an adjacent paragraph.

You'll also notice that some information is labeled **FYI** and is in italics. This information is optional reading—it's related to the information in the main text, but it's not vital to your understanding.

Imagewriter Controls and Parts

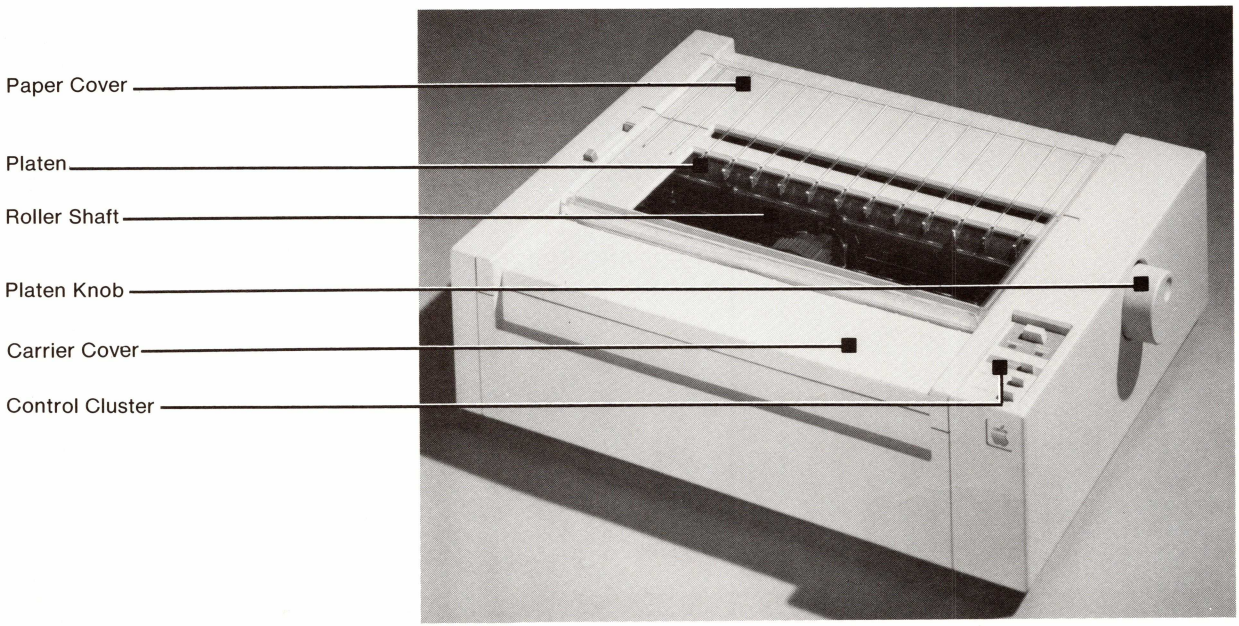
First a Few Names

Before proceeding further, you should take a minute to learn the names of your Apple Imagewriter's controls and parts. With your Imagewriter unpacked and sitting on the table in front of you, compare it with the labeled pictures.

Exterior Features

Figures 1-1 through 1-3 show the main external parts of the Imagewriter.

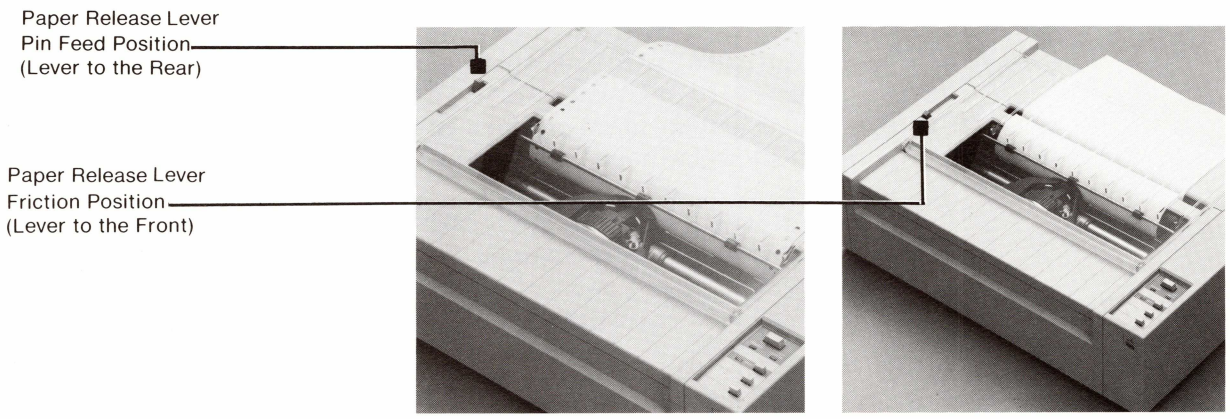
Figure 1-1. *Front View*



CONTROL CLUSTER: Contains the Imagewriter controls and indicators. These are described later in this chapter.

PLATEN:	The platen is used to: • roll paper forward in the friction feed mode. • provide a back support for the paper to rest against.
PLATEN KNOB:	Used to turn the platen when manually loading paper.
ROLLER SHAFT	Holds paper against the platen. The procedure for loading paper is described in Chapter 2, "Setting Up Your Imagewriter."
PAPER COVER:	Provides access for loading pin-feed paper, and prevents such things as dirt and paper clips from getting into the printer.
CARRIER COVER:	Provides access for changing the cassette ribbon, and also prevents such things as dirt and paper clips from getting into the printer. The printer will not operate unless the carrier cover is completely shut.
PAPER RELEASE LEVER	Releases platen friction when set in pin-feed position , the position used for pin-feed paper. Applies platen friction when set to friction position , the position used for ordinary paper with no pin-feed holes. The use of the paper release lever is described in Chapter 2, "Setting Up Your Imagewriter."

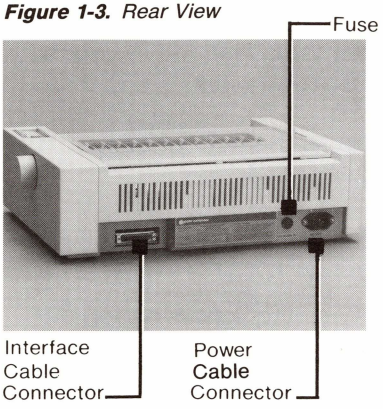
Figure 1-2. *Paper Release Lever Positions*



Warning

Don't touch the platen knob or paper release lever while the Imagewriter is printing.

Figure 1-3. *Rear View*



INTERFACE CABLE CONNECTOR: ---

Connector for Interface Cable that connects the Apple IIc to the Imagewriter.

POWER CABLE CONNECTOR: ~

Connector for power cable.

You will use the interface connector cable to connect the Imagewriter to your Apple IIc and will also connect the power cord to the Imagewriter, as described in Chapter 2, "Setting Up Your Imagewriter."

FUSE

Provides over-current protection for the Imagewriter.

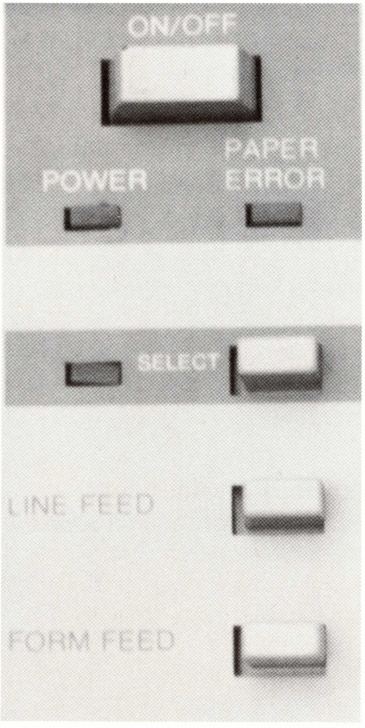
Controls and Indicators

You can operate your Apple Imagewriter entirely from your Apple IIc, but for convenience some control buttons and associated indicator lights are provided on the printer itself. Figure 1-4 shows the Imagewriter controls and indicators.

Note: All switch buttons in the control cluster alternate between two modes. Each time you press the button, the printer changes to the other mode. For example, the ON/OFF switch goes between on and off.

Warning
Do not attempt to plug in or operate your Imagewriter until you are ready to perform the built-in test described in Chapter 2, "Setting Up Your Imagewriter."

Figure 1-4. *Control Cluster, Controls and Indicators*



ON/OFF button:	Press to turn the printer on or off.
POWER light:	Turns on (green) when the printer is plugged in and the ON/OFF switch is on.
SELECT button:	Press to select or deselect the printer.
SELECT light:	Turns on (green) when the printer is selected. When the light is on (printer selected) your printer can receive data from the Apple IIc. When the light is off (printer not selected) you can control the printer with its control cluster switches, but the printer can't receive data from the computer.

By The Way: If you open the carrier cover while the Imagewriter is printing, the SELECT light will go out and the Imagewriter will stop. To resume printing, close the cover tightly and press the SELECT button.

Warning
Do not press the SELECT button to make the Apple Imagewriter print when there is no paper under the type head. This will damage both the type head and the platen.

LINE FEED button:

This button works only when the SELECT light is off. Press it once to move the paper up a line.

If you hold the LINE FEED switch button down, the printer will supply five individual line feeds and then continue to feed paper until you release the button.

FORM FEED button:

This button works only when the SELECT light is off. Press once to feed a full page of paper.

If you have aligned the top of a page with the print head, this button will feed to the top of the next page. (Normal setup of Imagewriter is for 11 inch pages; this may be changed to 12 inches.) Pressing the FORM FEED button is also a handy way to move a printed page up so it is more convenient to tear off.

By The Way: You can stop printing by pressing the SELECT button so that the SELECT light turns off. This deselects the printer, stopping data transfer from the computer. The printer will print out until its buffer is empty and then stop. While it is stopped, you can operate the LINE FEED and FORM FEED buttons. (Commands from the computer will be ignored.) To resume printing from the place you stopped, press the SELECT button so that the SELECT light turns on.

PAPER ERROR light:

Turns on (red) just before the printer runs out of paper.

The light turns on when there is only about an inch of paper left in the printer, and the printer stops printing. If you want to print the next line or so anyway (to finish a form that is nearly done, for example), just press the SELECT button once for each additional line to be printed.

Inside Your Imagewriter

Replacing the ribbon cassette and loading paper are described in Chapter 2. Cleaning and lubrication procedures are provided in Chapter 5.

Normally, the only times you'll need to open your printer will be to replace the ribbon cassette and pin-feed paper, adjust for paper thickness (if you change to multi-part forms, for instance), or for cleaning and lubrication. You should leave service of the working parts of your Apple Imagewriter to a qualified technician.

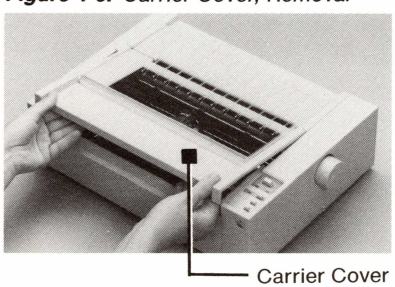
The carrier cover and the paper cover, Figures 1-5 and 1-6, help prevent dust, dirt and stray objects from getting inside the printer, and ensure that nothing interferes with the moving parts while they are working. The printer will not operate unless the carrier cover is completely shut.

Warning

Before opening either the paper cover or the carrier cover, always be sure the POWER light is off. This is good practice, even though opening the carrier cover does stop the printer.

To locate the interior parts, remove the covers as explained in the text accompanying Figures 1-5 and 1-6. Then refer to Figures 1-7 through 1-9 which show the main interior parts.

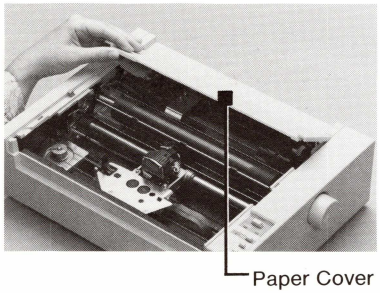
Figure 1-5. *Carrier Cover, Removal*



1. Remove the carrier cover, Figure 1-5, by lifting its front edge and sliding the cover toward the front of the machine.

The entire cover comes off. The clear plastic lid is hinged to allow access to the inside when loading or adjusting paper. The lid is normally kept closed.

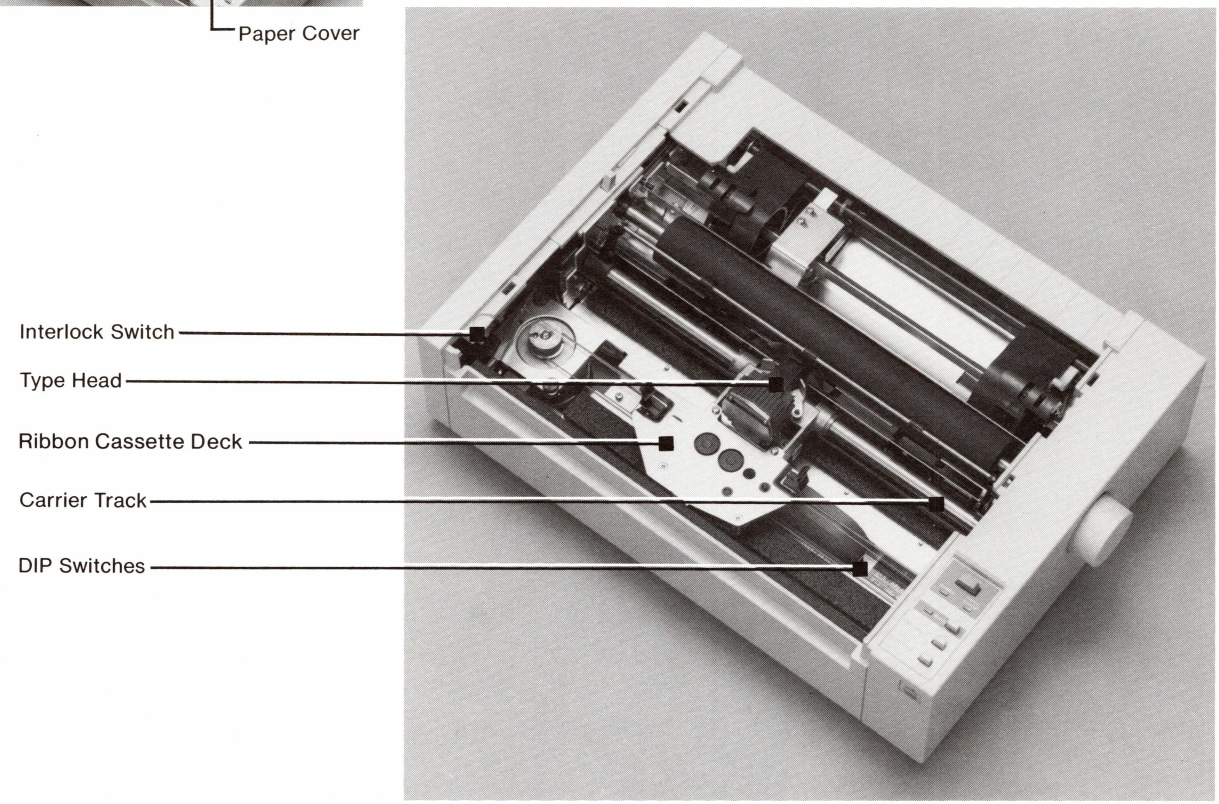
Figure 1-6. *Paper Cover, Removal*



2. Remove the paper cover, Figure 1-6, by holding it by the center and gently pulling up.

It should come up quite easily.

Figure 1-7. *Imagewriter Interior*



INTERLOCK SWITCH: A magnetic switch that stops printer when carrier cover is not in place.

CARRIER TRACK: The type head travels back and forth along this track.

DIP SWITCH ASSEMBLIES: The two DIP switches (SW1 and SW2) are located on the right side of the carrier track.

The normal settings of DIP switches SW1 and SW2 are shown in Figure 2-12.

Warning

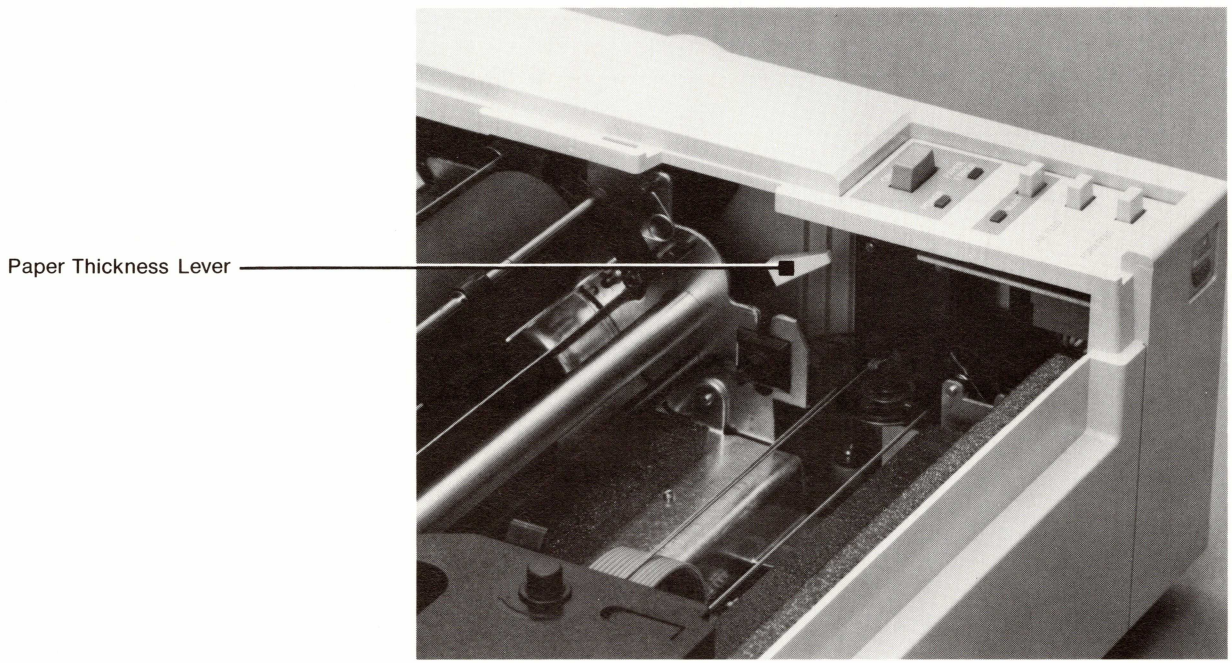
The two blue controls to the left of the DIP switch assembly should only be adjusted by a service technician. They control the strength of the printer impression and the alignment of the type head.

TYPE HEAD:

This is the dot matrix printing element that strikes the ribbon to print an image on the paper.

The type head sticks up through the ribbon cassette. It prints characters and graphics by the dot matrix method, in which each character or graphic image is formed by a pattern of dots.

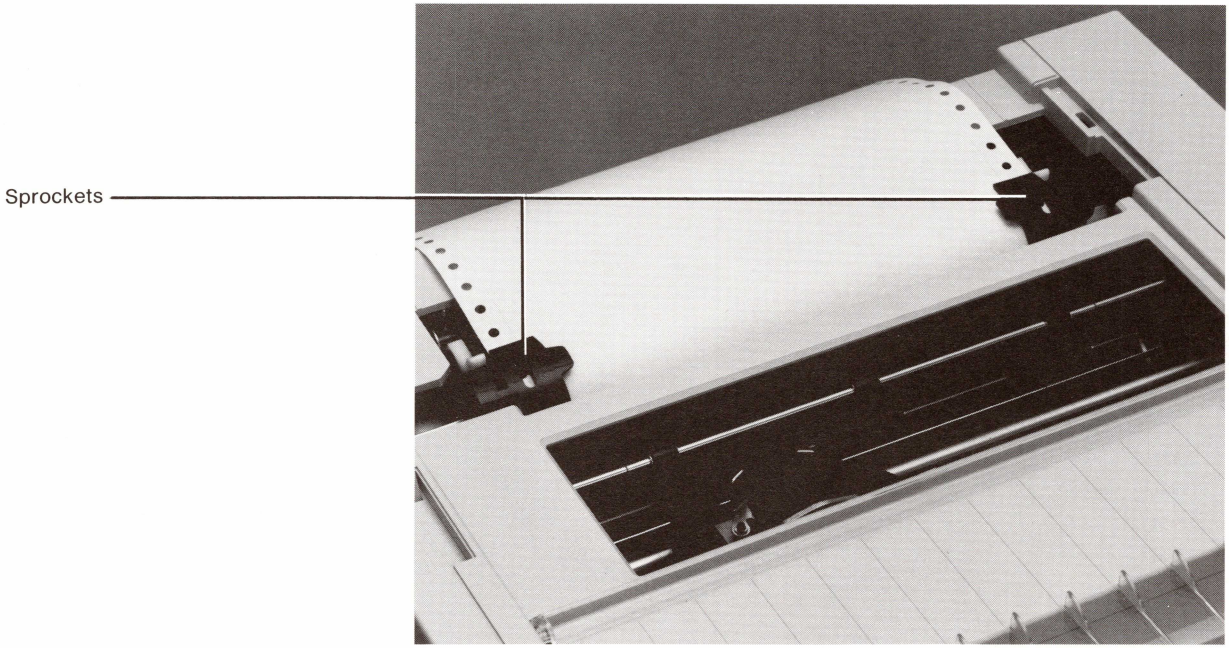
Figure 1-8. *Paper Thickness Lever*



PAPER THICKNESS LEVER:

Adjusts the position of the platen with respect to the type head.

Figure 1-9. *Imagewriter Sprockets*



SPROCKETS: Toothed wheels that move pin-feed paper through the printer.

You are now familiar with the main parts of the Imagewriter. In the next chapter you'll prepare your Imagewriter for use.

Setting Up Your Imagewriter

This chapter shows you how to get your Imagewriter up and running. You'll load the paper and ribbon, quickly check the setting of DIP switches SW1 and SW2, run the Imagewriter through a built-in test, and connect it to your Apple® IIc Personal Computer.

Selecting the Proper Location

Your Apple Imagewriter works best in a clean, vibration-free environment, away from such hazards as chemical fumes and spilled coffee. It is small, so you can place it on a shelf or on top of a file cabinet, where it will be out of the way; or you can put it on the back of a desk or table, where it will be easy to reach. The principal limitation on its location is the six-foot cable which connects your Imagewriter to your Apple IIc.

If you will be using any kind of paper other than single sheets, you will need room for the paper supply that feeds into the back of the printer. A stack of pin-feed paper behind the printer will require a space of about 9 inches by 12 inches. You can also place the printer on a small stand on your desk with the paper under it, or place the printer at the back of a desk, shelf, or table, with the paper supply in a box on the floor.

For Best Results: Ask your dealer to show you the Apple Stacker stand, designed especially for the Apple Imagewriter. It organizes both your cables and your continuous-feed paper, keeping your work area uncluttered.

Loading Paper

You can use two common types of paper:

1. Single Sheets of Paper
2. Pin-Feed Paper

Variations of these paper styles are: ordinary bond paper, business forms, letterhead paper, labels, and multiple part forms. You may find it more convenient to use special *pin-feed paper* made specially for computer driven printers. With pin-feed paper you don't have to load individual sheets. Pin-feed paper is very convenient as it feeds automatically, and once the left edge of the paper is adjusted, it stays adjusted.

Choosing the Right Kind of Paper

The Apple Imagewriter prints on ordinary bond paper, up to 24-pound weight. (Standard pin-feed computer paper usually comes in 15- and 20-pound weights.) Heavier paper may not feed properly; lighter paper, such as onionskin, may give a poor print image unless it is backed by a sheet of 15-pound bond.

You can also use multiple forms in your printer, provided their total thickness (including carbon sheets) does not exceed 0.28 millimeter (0.011 inch), or about the thickness of four sheets of 15-pound bond. You'll have to adjust the printer when printing on more than one sheet (see Adjusting for Paper Thickness later in this chapter).

You can adjust your Apple Imagewriter to accept pin-feed paper of from 3 to 10 inches in overall width. This includes standard 9-1/2 inch-wide pin-feed paper, which produces 8-1/2 by 11-inch finished pages after you tear off the perforation strips. You can also use several standard sizes of pin-feed label stock, for jobs such as printing mailing labels. If you like, you can position the paper so that the Imagewriter prints right up to the perforation line on either side (but not both sides at once).



Warning
Never put paper with staples or paper clips in your Apple Imagewriter.

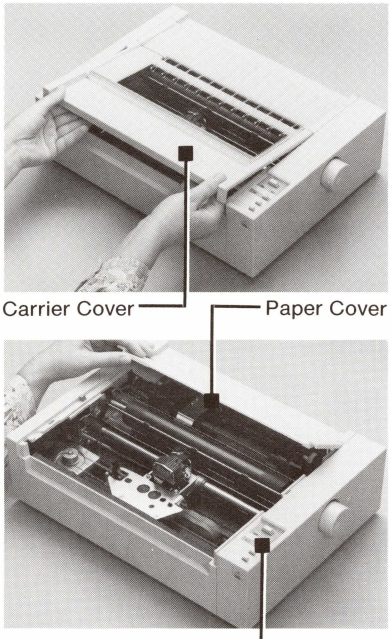
Note: The next two sections describe how to load pin-feed paper into your Apple Imagewriter. If you plan to use only single sheets of paper without pin-feed holes, skip ahead to the section called "Loading Plain Paper."

Setting the Pin-Feeder Width

Unless you switch to a different width of pin-feed paper, you only need to do this once.

The first time you use pin-feed paper in your Apple Imagewriter you will need to set the spacing of the *sprockets.* Here is how to do it:

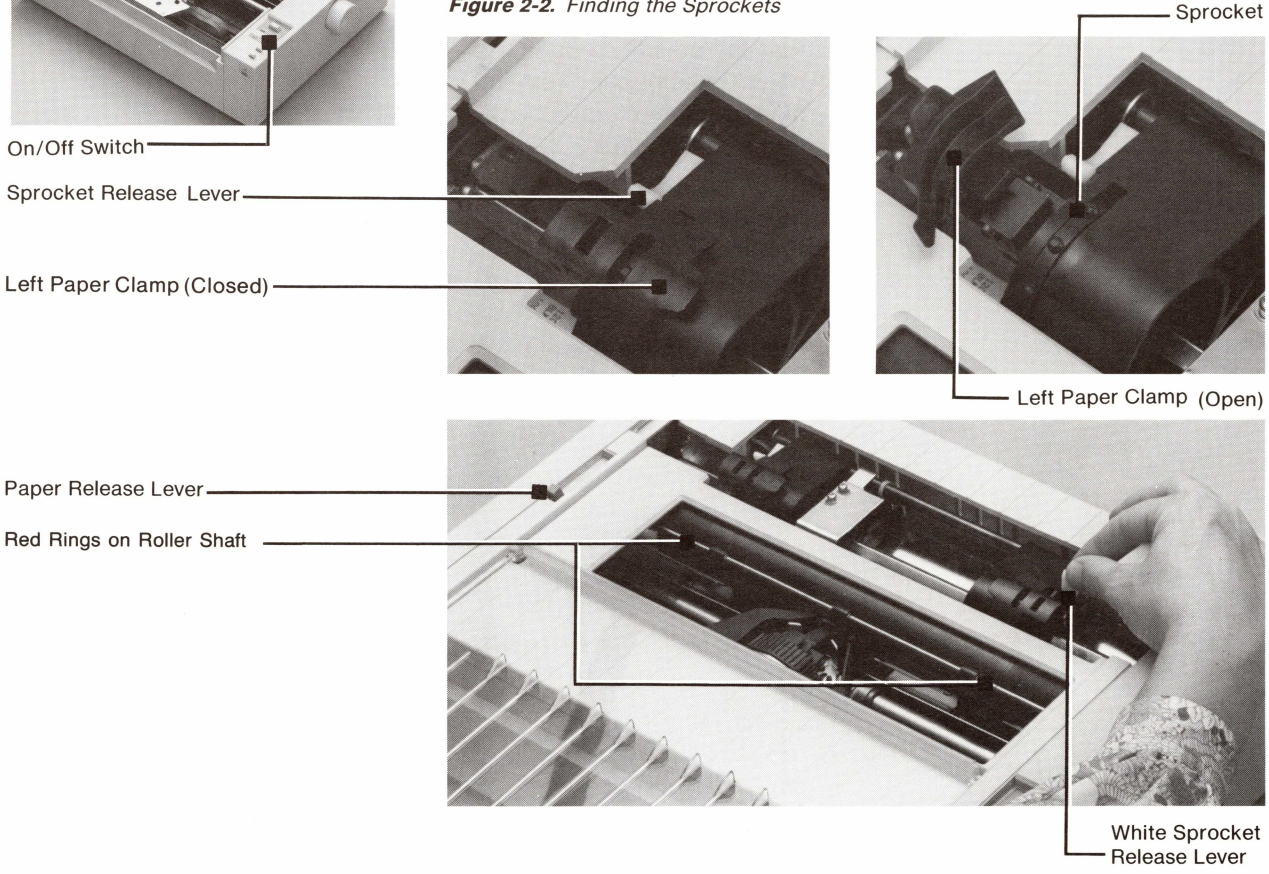
Figure 2-1. *Removing the Covers*



1. If the end of the paper you are going to use is not straight, tear it off at the nearest perforation.
2. Make sure the printer is off.
3. Remove both the carrier cover and the paper cover, Figure 2-1.
4. Open the sprocket paper clamps, Figure 2-2.

The sprockets are the two black plastic rollers with pins located inside the printer at the rear. Lift the hinged paper clamps, so they open up and swing outward.

Figure 2-2. *Finding the Sprockets*

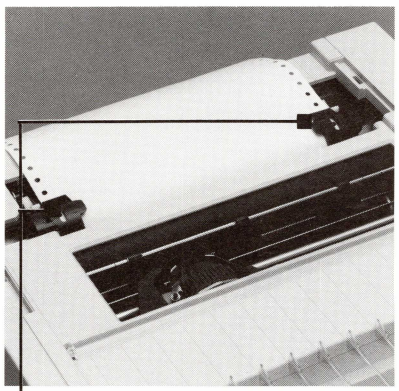


5. Release the black sprockets by lifting the white release levers at the rear of each sprocket assembly.

The white sprocket release levers are on the side of each sprocket.

When the white levers are pushed toward the rear, the sprockets are free to slide along their square shaft. When the levers are forward, the sprockets are locked in place.

Figure 2-3. *Adjusting the Sprockets*



6. Place the pin-feed paper over the sprockets and adjust the sprockets to the width of the paper.

7. Rotate the sprockets (by turning the platen knob) and position the paper so that the pins fit through the holes in the paper. Snap the hinged paper clamps back into place, Figure 2-3.

8. Set the paper release lever to the pin-feed (rear) position .

This allows the sprockets to push the paper around the platen.

9. Grasp the roller shaft at both ends and pull it forward.

10. Feed the forward end of the paper under the rubber platen and into the printer, as you would in a typewriter, by turning the platen knob clockwise.

11. Be sure that the paper release lever is still in the pin-feed (rear) position .

This releases friction on the paper so that you can easily move it.

12. Now move the two sprockets sideways, carrying the paper with them, until the paper is centered with respect to the printing area (two red rings) Figure 2-2.

The two red rings at each end of the roller shaft tell you where the margins of an eight-inch printed line occur.

13. When the paper is in place, pull the paper release lever forward to the friction position to hold it in place.

Push the roller shaft back against the paper.

14. Open the hinged paper clamp on each sprocket and push each of the white levers forward to lock the sprockets in place.

Make sure the sprocket pins fit easily in the holes in the paper, without pulling inward or outward.

15. Close the hinged sprocket paper clamps.

Again, check that the sprocket pins fit easily in the holes in the paper, without pulling inward or outward.

16. Move the paper release lever back to the pin-feed (rear) position .

The pin-feed position releases platen friction so that the pin-feed paper moves easily through the printer.

Loading Pin-Feed Paper

If you have just completed the previous section and your paper is already loaded, skip this section and go to "Setting the Top of the Page."

Follow these steps to re-load pin-feed paper into your Apple Imagewriter:

1. If the end of the paper you are going to use is not straight, tear it off at the nearest perforation.

2. Make sure the Imagewriter is off.

Imagewriter POWER light should be off.

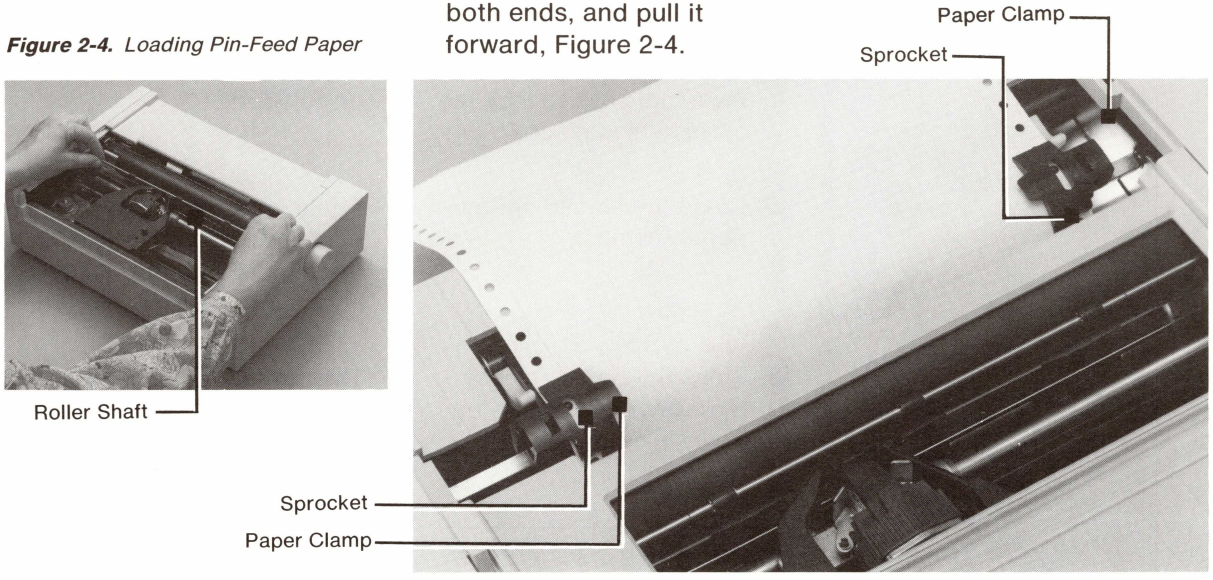
3. Remove both the carrier cover and the paper cover, Figure 2-1.

4. If necessary, set the pin-feeder width as just described.

5. Set the paper release lever to the pin-feed (rear) position ⊐ .

6. Grasp the roller shaft at both ends, and pull it forward, Figure 2-4.

Figure 2-4. *Loading Pin-Feed Paper*

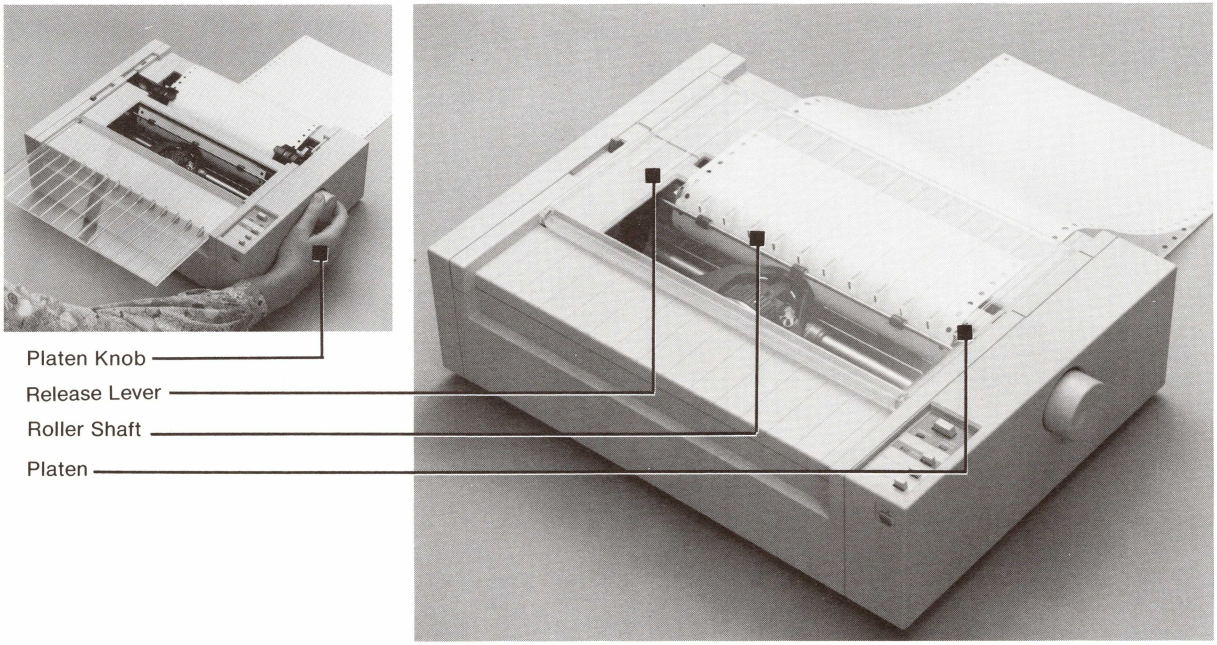


7. Lift the hinged paper clamps on the two black sprockets, folding them outward to expose the sprockets.

8. Place the paper over the sprockets so that the pins go through the paper holes. Snap the paper clamps back down to hold the paper in place.

9. Pull the pin-feed paper into the printer by turning the platen knob clockwise (top away from you), Figure 2-5.

Figure 2-5. *Pin-Feed Paper Loaded*



10. When the end of the paper comes up at the front of the platen, under the type head, snap the roller shaft shut against the paper, Figure 2-5.

11. Check that the paper release lever is in the pin-feed (rear) position, Figure 2-5.

12. Replace the paper cover and the carrier cover.

13. Line up the first perforation with the top of the type head.

This sets the top of your page and the paper will advance to the next perforation when you press the FORM FEED button.

(Normal setup of Imagewriter is for 11 inch pages; this may be changed to 12 inches. The page length and lines per page setting of SW1-4 must match. For example, SW1-4 is set to 66 for 11-inch paper.)

Also, the SELECT light must be off in order for the FORM FEED button to work.

Instructions for checking the setting of DIP switches SW1 and SW2 are given later in this chapter.

Loading Plain Paper

To load paper without pin-feed holes, refer to Figure 2-6 and do the following:

1. Make sure the Imagewriter is off.

2. Open the clear plastic lid on the top of the Imagewriter.

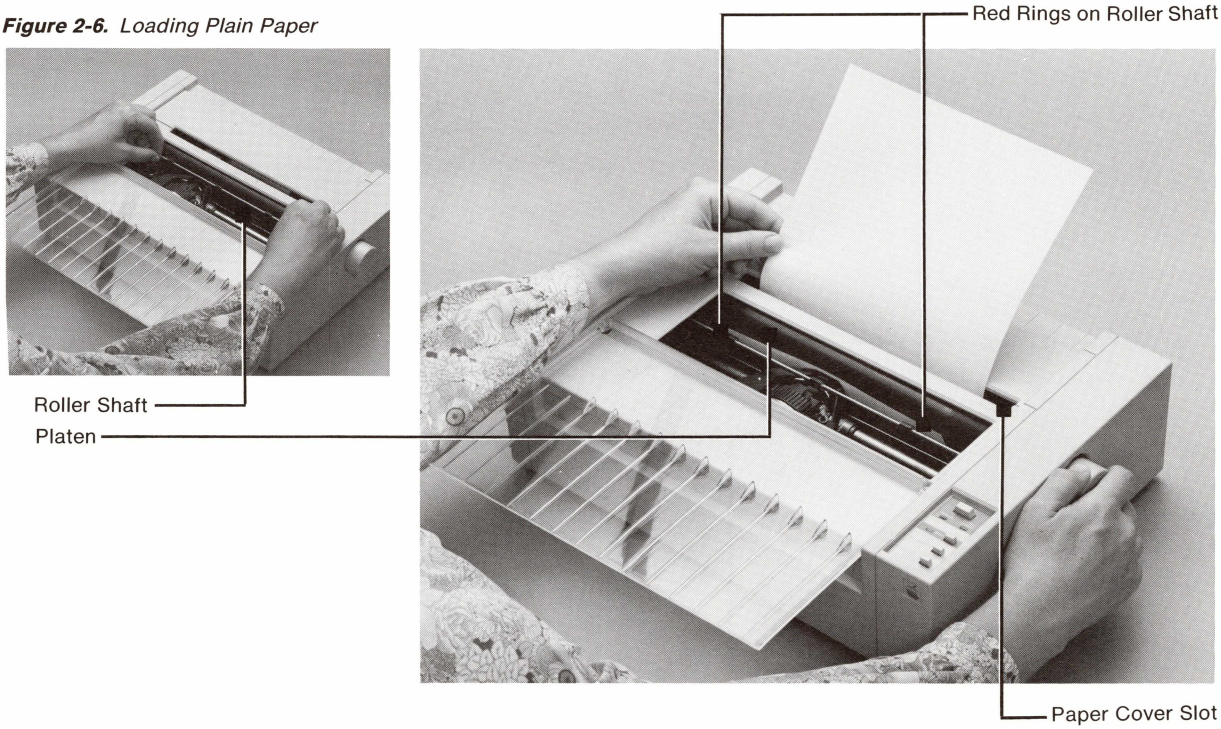
3. Grasp the roller shaft by both ends, and pull it forward, Figure 2-6.

4. Set the paper release lever to the friction (front) position  .

The friction position (front) allows the platen to pull the paper through the Imagewriter.

5. Push the end of the paper firmly down into the slot in the paper cover, so that it is snug against the platen.

Figure 2-6. *Loading Plain Paper*



6. Feed the paper around the platen as you would in a typewriter, by turning the platen knob clockwise to advance the paper.

   To get the paper started feeding, it is helpful to continue to push down on the paper as you turn the platen knob.

7. Temporarily set the paper release lever to the pin-feed (rear) position ⊐.

   The pin-feed ⊐ position releases most of the friction force against the paper so that the paper can easily be moved.

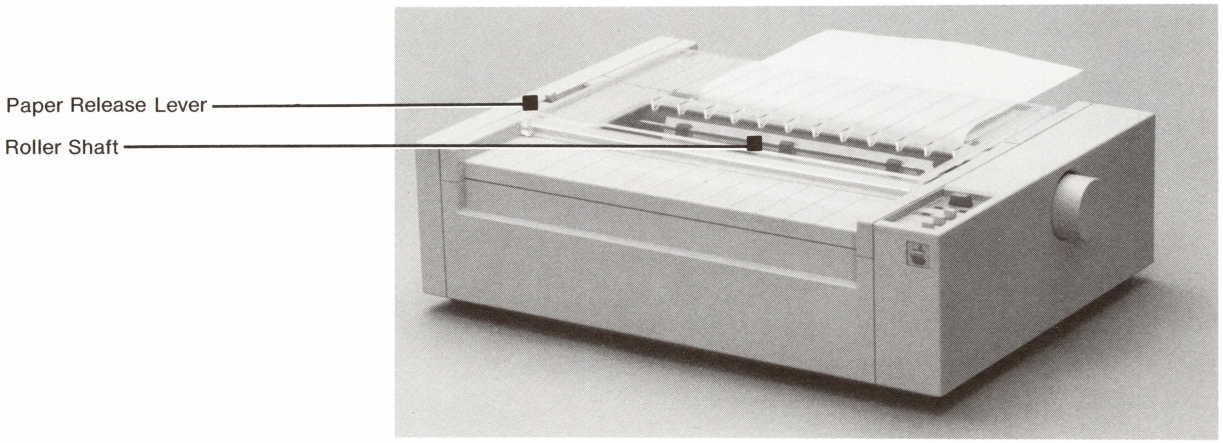
8. To align the paper exactly, you can pull the top edge of the paper up even with the bottom edge and move them together. To position the paper sideways, move it to the desired position with respect to the two red rings on the roller shaft.

   The red rings on the roller shaft show the limits of the printer's line of type, Figure 2-6.

9. Snap the roller shaft shut, Figure 2-7.

10. Move the paper release lever to the friction (forward) position , and turn platen knob to move paper to desired position.

Figure 2-7. *Plain Paper Loaded*



Setting the Top of the Page

When you press the FORM FEED button in the control cluster, the Apple Imagewriter feeds paper through to the top of the next page.

Pin-feed paper is perforated between pages, so pressing the FORM FEED button brings the paper to a handy place to tear it off.

By the Way: Your printer was set at the factory for a page length of 11 inches (66 lines). If you want to change the page length to 12 inches (72 lines), set SW1-4 to CLOSED. See "FYI: Imagewriter DIP Switch Settings," near the end of this chapter.

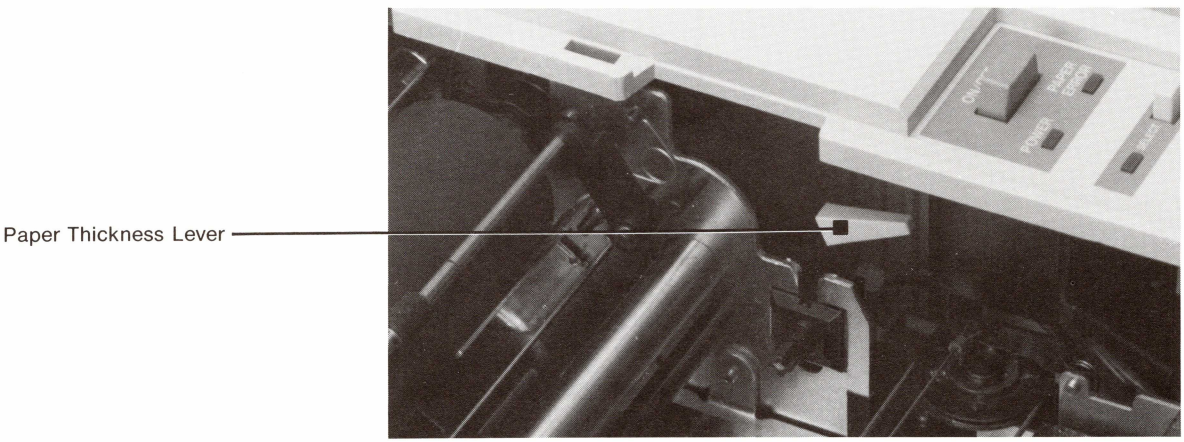
To position the top of form after you have loaded a new supply of pin-feed paper, make sure the power is off. Then simply turn the platen knob to bring the paper to the desired position. (Usually the top of the page should be level with the top of the type head.) Unless you turn the platen knob again or send control sequences to the printer to change the settings (instead of moving paper up by means of the LINE FEED button), the FORM FEED button will feed paper to the top of the next page each time you press it.

Adjusting for Paper Thickness

Your Apple Imagewriter will print higher-quality copies and give you longer service if you take care to adjust it to the correct thickness for the paper you are using.

1. Remove the carrier cover and look inside the printer. On the right side, near the platen knob, you will find a white plastic lever, Figure 2-8.

Figure 2-8. *Adjusting for Paper Thickness*



2. Push the lever all the way back (toward the platen), to print on a single thickness of ordinary paper.
3. Push the lever all the way forward (toward the control panel), to print on a four-sheet multiple form.

As you move the lever back and forth you can see a slight movement of the horizontal metal carrier bar on which the type head slides, compensating for the paper thickness. You can also feel that it clicks into four positions, corresponding to one to four sheets of ordinary paper.

Loading Envelopes

To load an envelope, follow the same procedure as for plain paper. You may have to change the paper thickness adjustment. An envelope will normally require a setting equivalent to two sheets of paper.

Installing and Removing the Ribbon Cassette

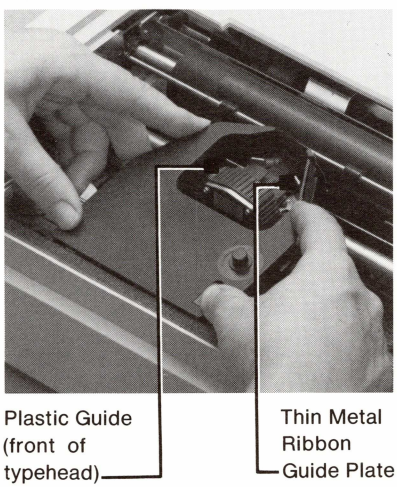
The ribbon cassette supplied with your printer is a special type, made specifically for this machine. You can get additional ribbons from your Apple dealer.

Note: If you have not yet removed the cardboard retainer that held the typehead from moving during shipment, do so now.

Changing ribbons is fast and easy. To install the ribbon that was packed with your printer, do the following:

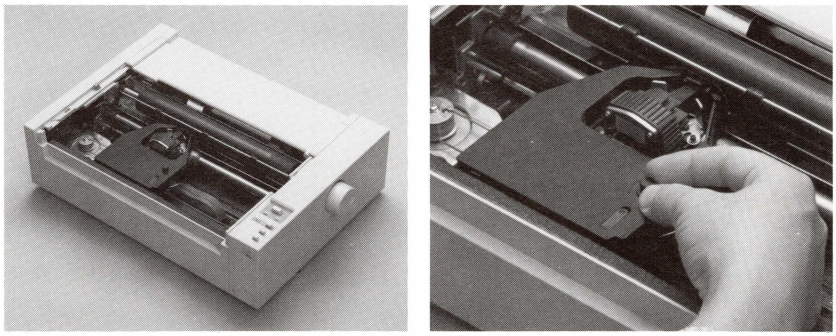
1. Make sure the power is off.
2. Remove the carrier cover.
3. Give yourself some working room by gently sliding the typehead toward the center of the carrier track, Figure 2-9.
4. Take up slack in the ribbon by turning the knob on the cassette once or twice in the direction of the arrow.
5. Carefully slip the exposed portion of the ribbon between the black plastic ribbon guide and the thin metal ribbon guide plate (the part that nearly touches the paper). At the same time, guide the cassette downwards onto the ribbon deck, Figure 2-10.

Figure 2-9. *Changing the Ribbon*



The two black plastic cassette support tabs (the parts that stick up) fit into the notches on the sides of the cassette, Figure 2-11.

Figure 2-10. *The Ribbon Loaded*

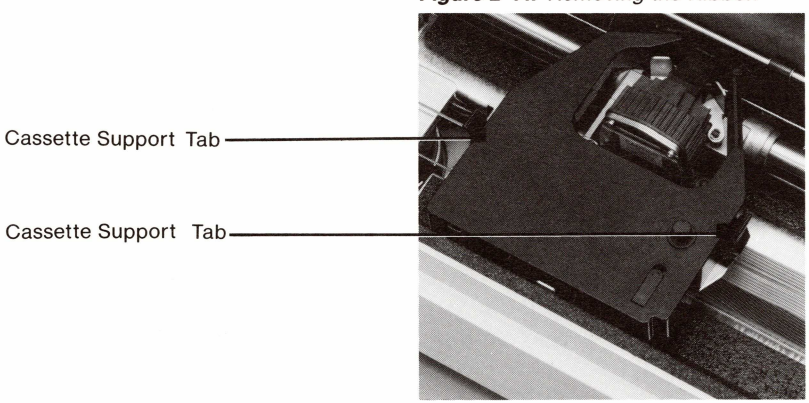


The cassette should easily snap in place with a single motion. When it does, replace the carrier cover.

If the ribbon cassette refuses to go down completely, or if the ribbon is caught in the space between the ribbon guide and guide plate, turn the knob on the cassette slowly in the direction of the arrow as you seat it. When properly installed, the cassette should lie flat on the ribbon deck. It shouldn't take much force.

To remove a used ribbon cassette, turn off the power and remove the carrier cover. Gently spread the two black plastic cassette support tabs, Figure 2-11, and lift up the cassette.

Figure 2-11. *Removing the Ribbon*



Warning
When pulling the cassette away, be careful not to get the ribbon caught between the ribbon guide and the guide plate.

Testing Your Imagewriter

Inside your Imagewriter is a microprocessor with a permanent program that can print a test alphabet on command. The printer does not need to be connected to a computer to run this program. It is a handy way to put the machine through its paces before connecting it to your system.

To run the built-in test, follow these steps:

1. If you have not already done so, load paper and ribbon into the printer.

2. Plug the printer into an electric power outlet and turn the printer on with the ON/OFF switch.

   The POWER light and SELECT lights should come on.



Warning
All electrical connections to your computer and peripheral equipment **must be grounded!** *Your Imagewriter is equipped with a three-prong power cord. As a safety feature, the plug is designed to fit only into a polarized, grounded three-hole outlet. If you don't have such an outlet, have a licensed electrician install one (and a grounding conductor, if necessary) where you will use your computer system. Do not defeat the purpose of the grounding plug.*

3. Press the SELECT button once to turn off the SELECT light.

4. Press the LINE FEED button a few times to make sure the paper feeds smoothly through the machine.

5. Turn the power off.

6. Press the FORM FEED button and continue holding it in while you turn the power back on. Then release the FORM FEED button.

The Apple Imagewriter will print its complete set of characters repeatedly until you press the ON/OFF switch to turn the power off. It takes 16 lines to print the entire pattern.

To stop the test, press the LINE FEED button.

7. Examine the print-out carefully.

All the characters should be complete (no dots missing) and neatly aligned. The lines should appear equally black from end to end. Spacing between characters and between lines should be even. If this is not the case, check for correct ribbon insertion, paper loading, and thickness settings. If the problem persists, please contact your Apple dealer.

Connecting the Imagewriter to Your Apple IIc

You need to read the beginning part of this chapter first.

The first part of this chapter explains how to set up your Imagewriter and prepare it for operation with your computer. If you haven't done so, read that before proceeding to connect the Imagewriter to the Apple IIc.

What You Need

To complete the installation of your Imagewriter you need the following items:

- Imagewriter Power Cord
- Imagewriter Interface Cable

About Your Cables: Your Imagewriter comes with a shielded interface cable to prevent radio and television interference.

The Imagewriter Power Cord comes with the Imagewriter. The shielded Imagewriter Interface Cable is included in the Apple Imagewriter accessory kit for the Apple IIc.

Imagewriter Setup and DIP Switch Check

Unless they have been changed, the switch positions as set at the factory should be as shown in Figure 2-12, and it should only be necessary to check them.

The Apple IIc sets itself up on power-on for normal operation of your Imagewriter. There are no special settings required on either your Apple IIc or your Imagewriter, except for checking the setting of DIP switches SW1 and SW2 on the Imagewriter. Therefore, installation can be completed in a very short time by just performing the following steps:

1. Be sure that the Apple IIc power is turned off, that any other attached equipment is turned off, and that the Imagewriter is turned off.

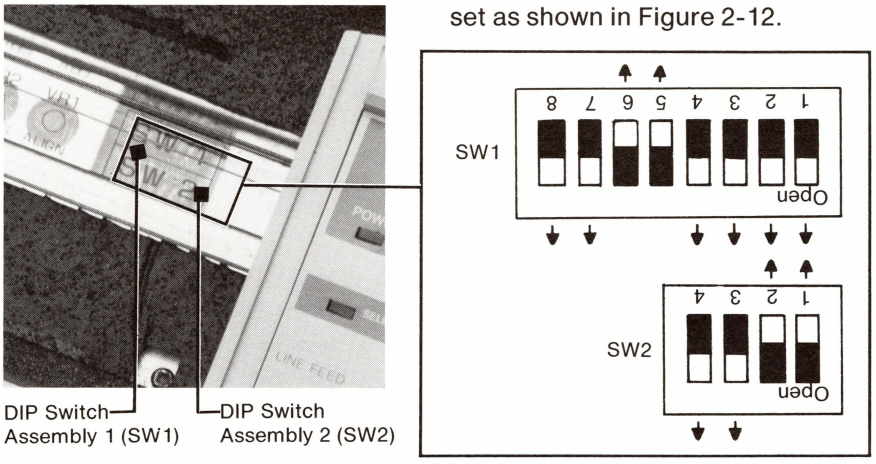
   If you haven't already done so, remove the carrier cover.

2. Check that Imagewriter switches SW1 and SW2 are set as shown in Figure 2-12.

   Should you have to change the setting of either DIP Switch SW1 or SW2 to make it match Figure 2-12, use something small like a round toothpick or small screwdriver. You shouldn't use a pencil or a pen, as residue from these objects could eventually damage the switch.

   Once you are sure the switches are set correctly, replace the carrier cover.

Figure 2-12. *DIP Switches SW1 and SW2*



Note:

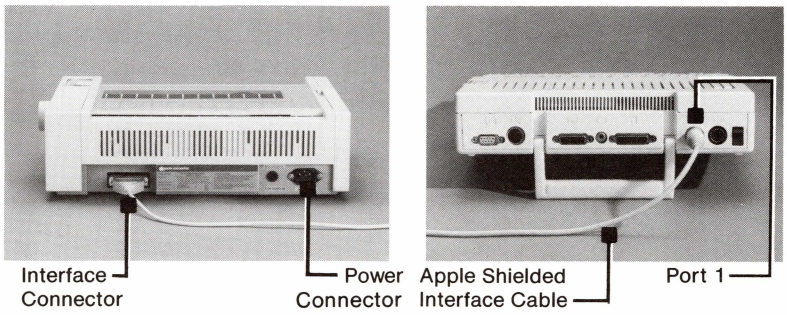


SWITCH SLIDER, Closed Position

SWITCH SLIDER, Open Position

3. Connect the D-shaped end of the printer's interface cable (the 25-pin end) to the interface connector on the back of your Imagewriter, Figure 2-13.
4. Connect the round end of the same interface cable (the 5-pin end) to Port 1 of your Apple IIc, Figure 2-13.
5. Plug the Imagewriter power cord into the Imagewriter and into a standard 110 VAC, 3-hole power outlet.

Figure 2-13. *Connecting Your Imagewriter*



Ready to Print

Your Imagewriter is all set up for printing. In the next chapter, you'll start printing using the Imagewriter with your Apple IIc.

FYI: Apple IIc Interface

When you turn on power to the Apple IIc, its printer serial port, Port 1, is automatically setup (configured) to communicate with the Imagewriter.

The System Utilities program disk for the Apple IIc uses a PIN (Product Identification-Number) system to simplify configuring the Apple IIc ports for various devices. The default setting for Port 1 of the Apple IIc is specifically set up for the Imagewriter with a PIN of 166/1124. The breakdown of the 166/1124 is as follows:

	Apple IIc, Port 1 PIN	
Printer Mode	=	1
8 Data Bits and 2 Stop Bits	=	6
9600 Baud	=	6
No Parity	=	1
Don't Echo Output	=	1
Insert Line Feed after Carriage Return	=	2
Insert Carriage Return after 80 Characters	=	4

You may change the configuration of Port 1 (the printer serial port) on the Apple IIc, but at power-on, it always resets to the default values just described.

For information on configuring Port 1, the serial printer port of the Apple IIc, refer to the Apple IIc *System Utilities* and the Apple IIc *System Reference* manuals.

The SW1 and SW2 switch settings shown in Figure 2-12 are correct for normal operation of the Imagewriter with the Apple IIc. If you are a programmer and want to change these settings for special programs, refer to Part II, Reference, the back part of this manual.

Applesoft, AppleWorks, Apple LOGO, Apple Pascal, and most application programs are designed to work with the Imagewriter connected to Port 1 of the Apple IIc. If you want to use the Imagewriter with other programs you may need to reconfigure your Apple IIc. Refer to the appropriate software manual and consult your Apple dealer.

FYI: Imagewriter DIP Switch Settings

You do not need to go any further in this chapter unless you want to read about the function of DIP switches SW1 and SW2.

For use with the Apple IIc, the normal position of DIP switches SW1 and SW2 on the Imagewriter are as indicated in capital letters. These settings are the same as shown in Figure 2-12.

SW1-1	*SW1-2*	*SW1-3*	
OPEN	**OPEN**	**OPEN**	**American**
Closed	*Closed*	*Open*	*British*
Open	*Open*	*Close*	*German*
Open	*Closed*	*Closed*	*French*
Closed	*Open*	*Closed*	*Swedish*
Closed	*Open*	*Open*	*Italian*
Closed	*Closed*	*Closed*	*Spanish*
Open	*Closed*	*Open*	*American*

SW1-4	
OPEN	**Page Length: 66 lines**
Closed	*Page Length: 72 lines*

SW1-5	
CLOSED	**Ignores 8th data bit, allowing reception of high ASCII as from Applesoft BASIC**
Open	*Recognizes 8th data bit*

SW1-6	*SW1-7*	
Open	*Open*	*Pica (10 chars. per inch)*
CLOSED	**OPEN**	**Elite (12 chars. per inch)**
Open	*Closed*	*Ultracondensed (17 chars. per inch)*
Closed	*Closed*	*Elite proportional (144 dots per inch)*

SW1-8	
Closed	*Adds line feed after every carriage return*
OPEN	**No line feed after carriage return**

SW2-1	*SW2-2*	
Open	*Open*	*300 Baud*
Closed	*Open*	*1200 Baud*
Open	*Closed*	*2400 Baud*
CLOSED	**CLOSED**	**9600 Baud**

SW2-3	
OPEN	**Data terminal ready**
Closed	*XON/XOFF (not used by Apple IIc)*

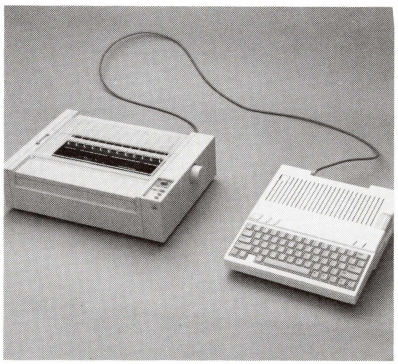
SW2-4	
OPEN	**(not used)**

Starting to Print

This chapter contains instructions for checking your Apple® IIc Personal Computer and Imagewriter setup. You will be using the Imagewriter to print from the Apple IIc's built-in Applesoft BASIC.

Preliminary Setup

Figure 3-1. *System Connection*



First, be sure that the Imagewriter and Apple IIc are connected correctly. (See Figure 3-1).

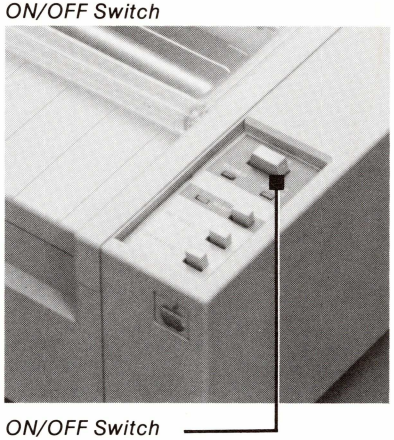
If you haven't done this, refer to the instructions in Chapter 2.

Be sure that the Imagewriter is loaded with paper and that a ribbon cassette has been installed.

If you haven't done this, refer to the instructions in Chapter 2.

Turning On the System

Figure 3-2. *Imagewriter ON/OFF Switch*



Perform the following steps to turn on the Apple IIc, Monitor, and Imagewriter:

1. Turn on the Imagewriter by pressing the ON/OFF switch. When you do, the POWER light comes on. (See Figure 3-2)

2. Turn on your monitor.

3. Turn on the Apple IIc by setting the power switch to 1. (Press the upper part of the switch.) See Figure 3-3.

If the power lights on the equipment do not turn on, check the power cable connections.

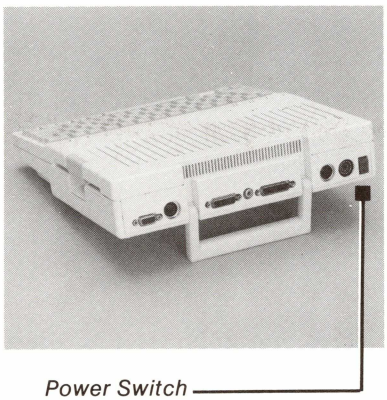
After the monitor warms up (in about 15 seconds) you should see the following display:

```
Apple IIc

Check Disk Drive
```

4. Ignore the `Check Disk Drive` message on the screen, and proceed to the next section, "Printing With Applesoft."

Figure 3-3. *Apple IIc Power Switch*



Important: The two printing examples in this chapter assume that no disks have been inserted in any of your Apple IIc drives. If you were using one or more disks, the two examples would be slightly different.

Printing with Applesoft

The following two procedures can be used to print with the Imagewriter.

Printing From the Keyboard

1. Press (CONTROL)-(RESET). (Both keys at the same time.)

You should see the following display.

```
Check Disk Drive
]■
```

2. Ignore the message `Check Disk Drive` Type the word HOME, which you will see displayed on the screen as you type. Press (RETURN).

The screen will clear, and the Applesoft BASIC prompt and the flashing cursor will move to the top left of the screen.

```
]■
```

3. Type the following:

`PRINT "HELLO"`

Press (RETURN).

You should see HELLO displayed on the screen.

4. Type the following:

`PR#1`

Press (RETURN).

This directs the keyboard output to the printer.

5. Now type a few words, for example:

`This is a test.`

Press (RETURN).

You won't see these words on the screen, but when you press (RETURN), they will be printed on the Imagewriter.

You may also see an error message, SYNTAX ERROR, printed. Ignore this. This is just Applesoft BASIC's way of saying that this is not its normal way of operating.

6. Press [RETURN] again and return the keyboard output to the screen by typing:

PR#0

If you type a long enough line, Applesoft BASIC will output the entire line to the printer without waiting for you to press [RETURN].

By The Way: The printing samples in this chapter are in the 40-column mode. For information of the 80-column mode and disk use, refer to the *Apple IIc Interactive Owner's Manual,* and your *Applesoft BASIC Programmer's Reference Manual.*

Printing From a Program

If you want to try something else, the following is a short program which you can run that will print first on the screen, then on the printer, and then back on the screen. This program is short, but typical of a straightforward BASIC printing routine.

1. Press [CONTROL]-[RESET] (Both keys simultaneously).

2. Type HOME and press [RETURN].

The screen will clear and the Applesoft BASIC prompt and flashing cursor will move to the top left corner of the screen.

3. Type the following program:

```
100 PRINT "Printing on Screen"
110 PR#1
120 PRINT "Printing on Imagewriter"
130 PR#0
140 PRINT "Printing on Screen again"
150 END
```

Press [RETURN] at the end of each line.

4. Type RUN and press [RETURN] to run the program.

FYI: A Few Applesoft Hints

If you make an error typing in a line of the above program but haven't pressed (RETURN) *yet, just use* (Left Arrow) *to backspace and retype the line from the point of the error.*

If you make a typing error and discover it after pressing (RETURN), *just type the line over again, being sure to repeat the same line number.*

If you type a line you don't want, and discover it after pressing (RETURN), *you can remove that line by just retyping only the line number and pressing* (RETURN).

If your screen gets a little cluttered with replaced lines, just type HOME *and press* (RETURN) *to clear your screen. Then type* LIST *and press* (RETURN) *to list all your current program lines.*

If you want to clear the computer's memory of all program lines with one command, type NEW *and press* (RETURN).

You can find additional editing techniques in the Applesoft BASIC Programmer's Reference Manual.

If It Doesn't Work the First Time

Don't be discouraged if your Imagewriter doesn't print the first time. Just refer to the following hints to get it going.

Is the Imagewriter POWER light on? Check that your Imagewriter is plugged in and turned on. Press the ON/OFF switch to turn on the POWER light.

Is the fuse blown? If the POWER light doesn't come on, check the fuse. The fuse receptacle is right next to the power connector on the Imagewriter. If the wire inside the fuse is broken, replace with a 2-ampere type 3AG fuse.

Is the SELECT light on? The SELECT light must be on for the Imagewriter to print. If it isn't, press the SELECT button.

Is the carrier cover closed? If it is open, an interlock switch prevents the Imagewriter from printing and turns off the SELECT light.

Are you out of paper? When there is less than one inch of paper left, an error detector under the platen stops the printer. If you want to print a few more lines, you can override this switch for a few lines by pressing the SELECT button.

Are Imagewriter DIP switches SW1 and SW2 set correctly? See Chapter 2, "Connecting the Imagewriter to Your Apple IIc" (Setup and SW1/SW2 Settings).

Is the interface cable loose? Turn off power on both the Apple IIc and the Imagewriter. Remove and reinstall the Imagewriter interface cable.

Is the Apple IIc configured correctly? Turn the Apple IIc off and back on again. This resets Port 1 of the Apple IIc to its default configuration, which is correct for the Imagewriter.

Is the program at fault? Run the Imagewriter built-in-test. If the built-in-test runs all right, most likely the problem is in the program being run on the Apple IIc.

See also Appendix A, "Troubleshooting," for a more comprehensive list of troubleshooting aids. If the problem persists, consult your Apple dealer.

Summary

In this chapter you have checked out your Apple IIc and Imagewriter setup. If you are using pre-packaged programs, you are ready to run them. You should check with your Apple dealer to verify that these programs are compatible with your Apple IIc and Imagewriter.

Imagewriter Graphics

Printing a Graphics Picture

You can quickly take a look at your Apple® IIc Personal Computer and Imagewriter graphics capabilities by using some of the functions of the Imagewriter Tool Kit Disk that comes with your Imagewriter accessory kit for the Apple IIc.

Programmers Note: This chapter only touches on the functions of the Imagewriter Tool Kit Disk. If you wish to do some of your own programming, Chapter 2 in Part II of this manual gives a further description of the Imagewriter Tool Kit functions, including the use of alternate type styles. Part II also contains a full description of the Imagewriter's advanced text printing commands to enable you to modify or write your own programs.

You'll need the Imagewriter Tool Kit Disk for Apple IIc which comes with the Imagewriter accessory kit for the Apple IIc. Proceed as follows:

1. Turn the Imagewriter on by pressing the ON/OFF switch so that the POWER light comes on.

2. Turn on your Monitor .

3. Insert the Imagewriter Tool Kit Disk for Apple IIc in the Apple IIc internal disk drive and close the door.

4. Turn on the Apple IIc by setting the power switch to 1. (Press down on the upper half of the switch.)

If your Apple IIc is already on, insert the Imagewriter Tool Kit disk in the internal drive and close the door. Then press (Apple)-(CONTROL)-(RESET) (all three keys at the same time).

When the drive stops and its light goes out, you'll see the following on your monitor screen:

```
IMAGEWRITER TOOL KIT
COPR 1984 APPLE COMPUTER
------------------------------------

          MAIN MENU

    1 - LOAD GRAPHIC IMAGE
    2 - SHOW GRAPHIC IMAGE
    3 - CHANGE PRINT OPTION
    4 - PRINT GRAPHIC IMAGE
    5 - DOWNLOAD SUBSCRIPT/SUPERSCRIPT
    6 - QUIT IMAGEWRITER TOOL KIT

------------------------------------
ENTER A NUMERIC SELECTION, OR USE THE
ARROW AND RETURN KEYS
```

5. Choose 1 - LOAD GRAPHIC IMAGE. You can do this either by moving the cursor with the Apple IIc arrow keys, or by pressing the (1) followed by (RETURN).

The Apple IIc will give you the following display:

```
IMAGEWRITER TOOL KIT
COPR 1984 APPLE COMPUTER
---------------------------------

        SELECT GRAPHIC IMAGE

    1 - LOAD USER IMAGE
    2 - CHANGE PRODOS PREFIX
    3 - CATALOG CURRENT DRIVE
    4 - APPLE IMAGEWRITER
    5 - SHAKESPEARE
    6 - EINSTEIN
    7 - DOUBLE BESSEL FUNCTION
    8 - DIP CHIPS
---------------------------------
ENTER A NUMERIC SELECTION, OR USE THE
ARROW AND RETURN KEYS
ESC - RETURN TO MAIN MENU
```

6. Select any sample graphics image (4 through 8) to load into the Apple IIc. For example, select number 4, the Imagewriter picture, by moving the arrow keys or by pressing [4] followed by [RETURN].

The built-in disk drive will whir as the Apple IIc loads your selection. The screen will return to the main menu:

```
IMAGEWRITER TOOL KIT
COPR 1984 APPLE COMPUTER
-----------------------------------------

                MAIN MENU

      1 - LOAD GRAPHIC IMAGE
      2 - SHOW GRAPHIC IMAGE
      3 - CHANGE PRINT OPTION
      4 - PRINT GRAPHIC IMAGE
      5 - DOWNLOAD SUBSCRIPT/SUPERSCRIPT
      6 - QUIT IMAGEWRITER TOOL KIT

-----------------------------------------
ENTER A NUMERIC SELECTION, OR USE THE
ARROW AND RETURN KEYS
```

7. Choose item 2 - SHOW GRAPHIC IMAGE.

   Your screen will fill with a picture of the Imagewriter.

8. Press (ESCAPE).

   Your screen will return to the main menu.

9. Choose 4 - PRINT GRAPHIC IMAGE, by typing (4) and pressing (RETURN).

   Your Imagewriter will print a picture of itself.

10. Choose 3 - CHANGE PRINT OPTION, by typing (3) and pressing (RETURN).

    Your Apple IIc will show the following screen display:

```
IMAGEWRITER TOOL KIT
COPR 1984 APPLE COMPUTER
------------------------------------

        CHANGE PRINT OPTIONS

        1 - SINGLE SIZE - NORMAL
        2 - SINGLE SIZE - INVERSE
        3 - DOUBLE SIZE - NORMAL
        4 - DOUBLE SIZE - INVERSE

------------------------------------
ENTER A NUMERIC SELECTION, OR USE THE
ARROW AND RETURN KEYS
ESC - RETURN TO MAIN MENU
```

11. Select an option, 1 - 4, and press (RETURN).

    Apple IIc will return to the main menu.

12. Select 4 - 8 from the main menu. For example, select "4" to print the Imagewriter picture again.

    It will be printed according to your print option selection.

13. Press (ESCAPE) one or more times to return to the main menu.

14. Repeat steps 5 through 12, as desired, to try out the different print options.

For more advanced operations, refer to Chapter 2 in Part II of this manual for detailed instructions on the use of the Imagewriter Tool Kit Disk.

Can't Escape? In case you find yourself in a position where [ESCAPE] doesn't get you where you want to go, you can always get back to the main menu by pressing [Apple]-[CONTROL]-[RESET]. (All three keys must be pressed at the same time.)

Figure 4-1. *Sample Imagewriter Graphics*





Caring for Your Imagewriter

Think of your Apple Imagewriter as a high-quality typewriter with a built-in microprocessor. By taking care of it as you would any other fine machine, you will save yourself repair bills and always be assured of getting the results the Imagewriter was designed to deliver.

Operating Environment

The Apple Imagewriter is intended to be used in a reasonably clean indoor location. It will work reliably in temperatures from 41 to 104 degrees Fahrenheit (5 to 40 degrees Celsius) with 10 to 85 percent humidity.



Warning
When you're not using your Imagewriter you can store it at temperatures of -13 to +140 degrees Fahrenheit (-25 to +60 degrees Celsius) without damage, but never try to run it at these extremes.

The Imagewriter's covers protect it adequately from dust and foreign objects, but they afford little protection against liquids or vapors. Spilling any liquid inside, or allowing the printer to be exposed to chemical or solvent fumes (including steam from a coffee maker), can harm it.

External Care

To clean the outside of the Imagewriter, just wipe it with a soft damp cloth. To remove stains or dirt, add a drop of liquid dish detergent to the cloth and wipe the surface of the printer.



Warning
Never use household cleansers, ammonia, powders, abrasives, or solvents such as cleaning fluid on the outside of the printer; they may damage the plastic.

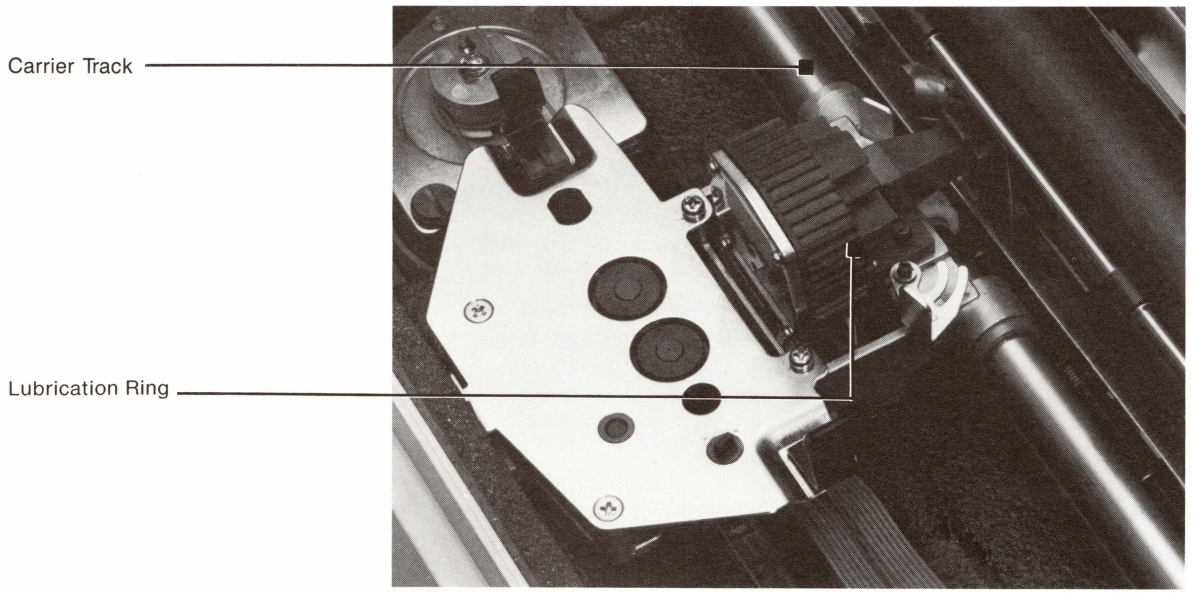
Internal Care

Under normal use, a yearly cleaning of the carrier track and a light oiling of the lubrication ring is recommended, Figure 5-1. Under more frequent use, cleaning and oiling should be done more often.

1. With the power off, remove the carrier cover.
2. Give yourself some working room by gently sliding the typehead toward the center of the carrier track.
3. Remove the ribbon cassette.
4. Look underneath the type head, Figure 5-1.

You will see a white felt ring encircling the horizontal metal carrier track. This is the lubrication ring. As the type head moves back and forth, oil soaked into this felt ring rubs off on the carrier track.

Figure 5-1. *Lubrication Ring and Carrier Track*



5. Carefully wipe the carrier track clean, using a cloth that will not leave lint behind.

If necessary, you can use a small amount of isopropyl alcohol on the cleaning cloth for stubborn areas of film or dirt.

6. Put two or three drops of light machine oil, such as a sewing machine oil, near the top of the felt ring.

Do not use electric motor oil or any lubrication that contains rust inhibitors. Be careful not to get oil on other parts of the mechanism.

7. Replace the ribbon cassette and carrier cover.

8. Finally, after you have everything in place, run the Imagewriter's built-in test for a few lines of print.

This will spread the new oil over the carrier track.

To perform the built-in test, turn the Imagewriter off. Then hold the FORM FEED button down and turn the printer back on. Release the FORM FEED button. To stop the test, press the ON/OFF switch again.



Warning
Be sure to load some paper in the Imagewriter before running the built-in-test.

Repacking

If you should have to ship or store your Imagewriter in the future, the original shipping carton makes the best container. To repack the Imagewriter, follow these steps:

1. Make sure the power is off.
2. Before repacking, gently move the type head to the center of the carrier track.
3. Remove the power cable, connecting cables, and ribbon cassette. Pack them separately in envelopes or plastic bags.
4. Place the cardboard type head protector inside the printer over the type head.
5. Close all covers securely and tape them down.

6. Place the entire printer in its plastic bag.

7. Place the foam forms on each end of the Imagewriter, and gently lower it (in its plastic bag) into the carton.

8. Put the ribbon cassette and power cable on top of the printer.

9. Store the connecting cable and manual in the accessory kit.

That's all there is to keeping your Imagewriter humming happily along year after year.



The Apple IIc

Imagewriter User's Manual
Part II: Reference

Applesoft and Pascal Programs

Chapter 1 Applesoft and Pascal Programs

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53 Printing Keyboard Input
53 Pascal Printing Program
53 Pascal Printing Features Program
55 Pascal Line-by-Line Printing

This chapter gives you different examples of printing from Applesoft and Pascal. It also gives examples of using the underline, boldface, and headline features. The use of these three features is typical of how the other features of the Imagewriter can be selected. For more information on these features, refer to *Functions You Can Change* in Chapter 3, "Controlling Your Printer", in this Part II section.

Important: The program examples in this chapter assume that you have inserted a ProDOS™ disk and that ProDOS is active. The print commands in the Applesoft BASIC example are for ProDOS.

Printing from Applesoft

Refer to your *Applesoft BASIC Programmer's Reference Manual* for more information on the PR# and PRINT commands.

The following program shows how various Imagewriter features can be selected by adding the appropriate commands to your program. This particular program selects the underline mode and then turns it off; selects boldface and then turns it off; and selects headline mode and then turns it off.

Saves some typing

Output to printer

CHR$ (34) replaces

```
100 HOME :ESC$ = CHR$(27)
110 PRINT "Test to Screen"
120 PRINT CHR$ (4);"PR#1"
130 PRINT "Test to Printer"
140 PRINT ESC$; "X"
150 PRINT "Underlined"
160 PRINT ESC$; "Y"
170 PRINT "Underlined Ended"
180 PRINT ESC$; "!"
190 PRINT "This is in boldface"
200 PRINT ESC$; CHR$(34)
210 PRINT "Boldface Ended"
220 PRINT CHR$ (14)
230 PRINT "This is the Headline Mode"
240 PRINT CHR$ (15)
```

Output to screen

```
250 PRINT "This Ends Headline Mode"
260 PRINT CHR$ (4); "PR# 0"
270 END
```

When you run this program, it will display `Test to Screen` on your monitor, then print out seven lines to the printer, as shown in Figure 1-1.

Figure 1-1. *Applesoft Printing Sample*

```
Test to Printer

Underlined

Underlined Ended

This is in boldface

Boldface Ended

This is the Headline Mode

This Ends Headline Mode
```

Printing From Pascal

You can use the Imagewriter with an Apple II Pascal program in a number of different ways.

Printing Text Files From Disk

You can print a disk text file by using the Pascal Filer's Transfer command, like this:

Prompt: `Transfer what file?`
Response: <filename>

Prompt: `To what file?`
Response: `PRINTER:`

Printing Keyboard Input

You can use the Filer to send text that you type directly to your printer by using the Transfer command, like this:

Prompt: `Transfer what file?`
Response: `console:,printer:`

Whatever you type will appear on your monitor screen, until you press (CONTROL)-(C). When you do that, everything that you have typed will be sent to the printer. You can include Imagewriter command codes in your text (to produce underlined or boldface text, for example), as long as you do not use any printer control code that include (CONTROL)-(C).

Pascal Printing Program

Here is an example of a Pascal program that sends characters to the printer:

```
PROGRAM Printer;          A trivial program, but it works!

VAR Prntr:TEXT;

BEGIN
 REWRITE(Prntr,'PRINTER:');
                          Open a file for use. In this
                          case, Pascal's predefined
                          printer port.

 WRITELN(Prntr,'This is a test.');
                          Send characters to the file.
 CLOSE(Prntr);            Close the file.
END.
```

For more information on Pascal file and device use, see the *Apple II Pascal Operating System Reference Manual.*

Note that all input and output (I/O) in Pascal programs is through files. The Pascal system predefines Port 1 as belonging to the system printer, called "PRINTER:". If "prntr", or some other filename previously defined as referring to "PRINTER:", had not been included in the WRITELN statement, Pascal would have sent the text to your monitor.

Pascal Printing Features Program

This example adds a couple of statements to the previous program to select the underline feature of the Imagewriter. Notice that one of the added program statements selects the underline feature and that another statement is required to end the underline mode. This program illustrates the general method for selecting printer features from a Pascal program.

```
PROGRAM Printertwo;

VAR Prntr:TEXT;

BEGIN
 REWRITE(Prntr,'PRINTER:');   Open a file for use. In this case, Pascal's predefined printer port.
 WRITELN(Prntr,'This is a test.');
                              Send characters to the file.

 WRITE(Prntr, chr(27),'X');   Selects underline feature, ESC X.

 WRITELN(Prntr,'Underline selected.');
                              Send characters to the file.

 WRITE(Prntr,'chr(27),'Y');   Ends underline


 WRITELN(Prntr,'Underline ended )
                              Send characters to the file.

CLOSE(Prntr);                 Close the file.
END.
```

When you run this file, it will print the following three lines:

This is a test.

Underline selected

Underline ended.

Pascal Line-by-Line Printing

The following simple Pascal program can be used to transfer characters from the keyboard to the printer on a line-by-line basis, allowing you, in effect, to use your printer as a typewriter. Press (CONTROL)-(C) to exit the program.

```
PROGRAM Typewriter;

VAR    prntr:TEXT;
       buff:STRING;

BEGIN
  REWRITE(Prntr,'PRINTER');
 WRITELN('Keyboard to Printer transfer - <ctrlC> to exit');
 WHILE NOT EOF DO
     BEGIN
       READLN(buff);
        WRITELN(Prntr,buff)
     END;
 CLOSE(Prntr)
END.
```

Note the Difference: When you use the Transfer command of the Filer to type directly to the printer, the text is *not* sent to the printer line-by-line; it is printed only after you type the end of file character, (CONTROL)-(C).

Imagewriter Tool Kit Disk

Chapter 2 Imagewriter Tool Kit Disk

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61 Superscript/Subscript Example

Imagewriter Tool Kit Description

The Imagewriter Tool Kit disk for the Apple® IIc Personal Computer, which comes with your Apple IIc Imagewriter accessory kit, contains a menu-driven program that has two main functions:

- To print Apple IIc high-resolution graphics pictures.
- To transfer a special font of superscript and subscript characters to the Imagewriter.

The Imagewriter Tool Kit works with 40 column (television set) and 80 column (computer monitor) displays.

Let's take a walk through the program to become familiar with it.

First, insert the Apple IIc Imagewriter Tool Kit disk in the built-in disk drive, close the drive door, and turn on your Apple IIc. When the drive stops whirring, you will see the following:

```
IMAGEWRITER TOOL KIT
COPR 1984 APPLE COMPUTER
----------------------------------------

            MAIN MENU

    1 - LOAD GRAPHIC IMAGE
    2 - SHOW GRAPHIC IMAGE
    3 - CHANGE PRINT OPTION
    4 - PRINT GRAPHIC IMAGE
    5 - DOWNLOAD SUBSCRIPT/SUPERSCRIPT
    6 - QUIT IMAGEWRITER TOOL KIT

----------------------------------------
ENTER A NUMERIC SELECTION, OR USE THE
ARROW AND RETURN KEYS
ESC - RETURN TO MAIN MENU
```

By The Way: The Imagewriter Tool Kit Disk samples shown here correspond to the high-resolution 40-column mode of a monitor, which is equivalent to 280 by 192 dots across 40 columns and 24 rows on the monitor. Double-high resolution on a monitor is 560 by 192 dots across 80 columns and 24 rows. Low-resolution on a monitor is 48 dots by 48 dots across the screen.

From this point on, you make choices by moving the cursor to the operation that you wish to perform. You can do this either by moving the cursor with the arrow keys on your Apple IIc, or by pressing the number of the operation followed by [RETURN].

Pressing [ESCAPE] will return you to the menu of the previous level without performing any operation. This lets you back away from doing something that you might decide that you don't want to do. The only exceptions to this are when you are in the main menu (nothing happens) and when an operation is in progress (it's too late to change your mind).

Main menu option 1, LOAD GRAPHIC IMAGE, brings up the following display:

```
IMAGEWRITER TOOL KIT
COPR 1984 APPLE COMPUTER
----------------------------------------

      SELECT GRAPHIC IMAGE

   1 - LOAD USER IMAGE
   2 - CHANGE PRODOS PREFIX
   3 - CATALOG CURRENT DRIVE
   4 - APPLE IMAGEWRITER
   5 - SHAKESPEARE
   6 - EINSTEIN
   7 - DOUBLE BESSEL FUNCTION
   8 - DIP CHIPS


   PLEASE SELECT A NUMBER =>1
----------------------------------------
ENTER A NUMERIC SELECTION, OR USE THE
ARROW AND RETURN KEYS
ESC - RETURN TO MAIN MENU
```

- Option 1, Load User Image, lets you load graphic images from a ProDOS disk in the current drive.

  A catalog of the disk's directory is displayed. Choose the image to load into memory by typing the full name of the file and pressing (RETURN).

- Option 2, Change ProDOS Prefix, lets you specify which drive you want to use. You are asked to name the drive number. Default value is drive 1 (the internal drive), which is the one you want.

- Option 3, Catalog Current Drive, displays a catalog of the contents of the disk in the current drive.

- Options 4 through 8 let you choose one of the demonstration pictures stored on the Imagewriter Tool Kit disk.

Main menu option 2, SHOW GRAPHIC IMAGE, displays on the screen whatever is currently in the high-resolution graphics page in memory. If you haven't loaded a picture, the display will be random hash. You can print this, using main menu option 4, but it really won't be very interesting.

Main menu option 3, CHANGE PRINT OPTION, brings up the following display.

```
IMAGEWRITER TOOL KIT
COPR 1984 APPLE COMPUTER
----------------------------------------


      SELECT PRINT OPTION

   1 - SINGLE SIZE - NORMAL
   2 - SINGLE SIZE - INVERSE
   3 - DOUBLE SIZE - NORMAL
   4 - DOUBLE SIZE - INVERSE


PLEASE SELECT A NUMBER =>4
----------------------------------------
ENTER A NUMERIC SELECTION, OR USE THE
ARROW AND RETURN KEYS
ESC - RETURN TO MAIN MENU
```

The default condition is option 4. This is best suited to most graphics subjects. If your picture is a portrait, such as the Einstein image supplied with the Imagewriter Tool Kit, then option 3, double-size normal printing, would be better.

The other two printing options are useful if you have narrow paper in your Imagewriter, or if you want to leave the right side of the paper free for printing something else such as text.

Main menu option 4, PRINT GRAPHIC IMAGE, will print whatever is in the graphics page of memory of the Apple IIc.

Table 2-1. Superscript and Subscript Characters

Superscript		Subscript	
Character	**Results**	**Character**	**Results**
A	A	a	A
B	B	b	B
C	C	c	C
D	D	d	D
E	E	e	E
F	F	f	F
G	G	g	G
H	H	h	H
I	I	i	I
J	J	j	J
K	K	k	K
L	L	l	L
M	M	m	M
N	N	n	N
O	O	o	O
P	P	p	P
Q	Q	q	Q
R	R	r	R
S	S	s	S
T	T	t	T
U	U	u	U
V	V	v	V
W	W	w	W
X	X	x	X
Y	Y	y	Y
Z	Z	z	Z
!	1	1	1
"	2	2	2
#	3	3	3
$	4	4	4
%	5	5	5
&	6	6	6
:	7	7	7
(	8	8	8
)	9	9	9
@	Ø	Ø	Ø
+	+	;	+
=	-	-	-
*	:	:	'
?	/	?	/
<	(	,	(
>	)	.	)

For information on using custom fonts for selecting the subscript and superscript characters downloaded from the tool kit, see the next chapter, "Controlling Your Printer."

Main menu option 5, DOWNLOAD SUBSCRIPT/SUPERSCRIPT, lets you download a custom character font to the Imagewriter, in this case a set of subscript and superscript characters. They can be used in any text printed by the Imagewriter by selecting the custom character font. The custom character font remains in the Imagewriter's memory until either the printer is turned off or another character font is loaded.

Table 2-1 shows the superscript and subscript character fonts and the key to press to get the character you want.

Main menu option 6, Quit Imagewriter Tool Kit, returns you to ProDOS. You can then insert the program disk you were using and enter the desired path name and file name to return to the program you were using.

Superscript/Subscript Example

The following is an Applesoft BASIC program example of printing superscript and subscript characters.

First you must insert the Imagewriter Tool Kit Disk in your Apple IIc and press [Apple]-[CONTROL]-[RESET] to load the tool kit. Now turn on your Imagewriter and press the SELECT button to light the SELECT light if it's not already lighted. From the main menu of the Imagewriter Tool Kit display on your Apple IIc, select 5 - DOWNLOAD SUBSCRIPT/SUPERSCRIPT by either moving the cursor or pressing the number [5] followed by [RETURN].

The Imagewriter now has the subscript/superscript font loaded as a custom font and will retain it in memory until turned off. Remove the Imagewriter Tool Kit Disk and insert the ProDOS User's Disk in your Apple IIc. Press [Apple]-[CONTROL]-[RESET] to load the ProDOS disk.

From the menu of the ProDOS User's Disk, select BASIC. Then type NEW and press [RETURN] key to clear memory. Type HOME and press [RETURN] to clear the screen and move the cursor to the top left of the screen.

Now, enter the following program:

```
100 ESC$ = CHR$ (27)
110 CN$ = ESC$ + "'" : REM Define Custom
Character turn on for later use
120 CO$ = ESC$ + "$" : REM Define Custom
Character turn off for later use
130 PRINT CHR$ (4); "PR#1" :REM ProDOS
type printer command
140 PRINT "This is a Superscript sample:"
150 PRINT "Area = PiR";CN$; CHR$ (34);CO$
160 PRINT "This is a Subscript sample :"
170 PRINT "R";CN$;"t";CO$;" =
R";CN$;"1";CO$;" + R";CN$;"2";CO$
180 PRINT CHR$ (4);"PR#0" : REM ProDOS
return to screen command
190 END
```

When you run this program, it will print out the text shown in Figure 2-1

Figure 2-1 *Applesoft Subscript/Superscript Example*

```
This is a Superscript sample:
Area = PiR²
This is a Subscript sample:
RT = R1 + R2
```

Chapter 3 Controlling Your Printer

66 Changing the Standard Instructions
67 DIP Switch Settings
68 Control Codes
68 Control Characters
68 Control Sequences
69 Functions You Can Change
71 Baud Setting
71 Serial Interface Protocol
71 Character Pitch
73 Proportional Character Spacing
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81 Multiple Line Feeding
81 Left Margin Setting
82 Page Length
82 Form Feeding
83 Top of Form Set Command
83 Paper Error Detection
83 Restoring Standard Instructions

This chapter describes how to take advantage of some of the versatile capabilities of the Apple Imagewriter. With the technical information in this chapter, you can change the printing *format* of your printer to fit your personal requirements.

The dot matrix printing method gives you maximum flexibility to create written records in exactly the form you want. Besides letting you format ordinary text with a full range of tabbing controls and typographical options (such as boldface printing), the Apple Imagewriter lets you create alphabets of custom characters and even construct page-size *graphics* patterns by the placement of individual dots. Here's what your Apple Imagewriter can do for you:

- Print all the letters, numbers, and punctuation marks that you can type on your Apple computer keyboard or display on the video screen. In addition, it can print foreign language characters.
- Set the number of characters per inch (*character pitch*) to 9, 10, 12, 13.4, 15, or 17. Two additional options allow the character pitch to be determined by the width of each character. Pitches can be mixed within a line.
- Set the spacing between lines (*line feed pitch*) to increments of 1/144 inch, including the standard six or eight lines per inch. Line spacing can be changed within any line.
- Feed paper both up and down, permitting the generation of mathematical formulas and the placement of subscripts and superscripts.
- Set page length to any number of lines up to 72, to conform to standard page length, or allow the print-out to be continuous, without page breaks.
- Print zeros either unslashed (0) or slashed (Ø).

- Print in boldface. The printer does this by printing each character twice, with a small shift of position.
- Underline text.
- Print in double-width headline style.
- Change the location of the left-hand printed margin. The location of the right-hand margin is usually determined by the program you use in your Apple computer.
- Easily fill out complex forms by using a complete set of preprogrammed tab controls—including format specifications for an entire page.
- Print symbols or alternate language characters you design yourself. You can add up to 175 8-dot-by-8-dot characters, or 95 characters that are 8 dots high by 16 dots wide. You can mix these special symbols freely with the standard alphabets and print them with all the formatting features listed above.
- Print drawings, graphs, diagrams, and similar line graphics, by instructing your Apple Imagewriter to print individual dots in specific locations. The available resolution of 160 dots to the inch horizontally and 144 to the inch vertically produces sharp, unbroken lines. You can print graphics up to eight inches wide and any height.

You can accomplish all of this through the relatively simple programming techniques described in this chapter and the next.

Changing the Standard Instructions

Your printer gets its information on how to behave from three sources:

- its microprocessor, the "brain" of the printer
- DIP switches inside the printer case
- formatting commands from your computer

Each time you turn on the printer, the microprocessor is ready to follow a certain set of rules (called *standard instructions*) on how to print—unless you change the rules. Some of the standard instructions are stored within the microprocessor itself, while other instructions are determined by DIP switch settings. For example, the microprocessor automatically instructs the printer to print 6 lines per vertical inch; the way the DIP switches are set at the

factory causes the microprocessor to instruct the printer to print 66 lines per page, to print bidirectionally, and so on.

You can override these rules in two ways: by changing the DIP switch settings and by sending special *control codes* to your printer.

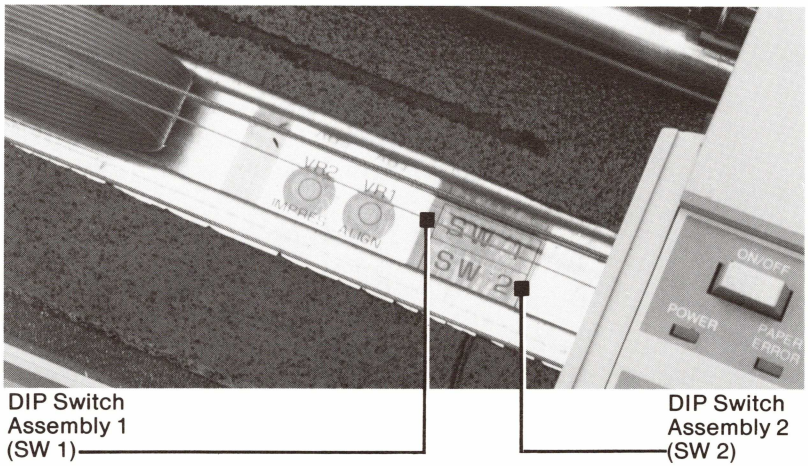
DIP Switch Settings

One way to change the rules is to change the DIP switch settings. Most DIP switch settings affect printer functions that you seldom need to change, such as page length. By setting the appropriate DIP switch in advance, you know that every time you turn the power on, the printer will make each page a certain length—say, 66 lines.

DIP stands for dual in-line package, which is a technical description of the physical form of these switches. When your printer's carrier cover is removed and the type head is at the far left, you can see the two DIP switch assemblies in the bottom of the machine at the right. They are covered with a flap of clear plastic.

There are two DIP switch assemblies: switch assembly 1 (SW 1) is toward the back of the machine and contains eight switches, numbered 1 through 8. Switch assembly 2 (SW 2) is toward the front and contains four switches, numbered 1 through 4. Individual switches are identified by the switch assembly name followed by the individual switch number—for example, switch 2-4 or SW 2-4 is switch number 4 on assembly 2.

Figure 3-1. *DIP Switches*



To change a DIP switch setting, turn the power off, curl back the plastic cover to the left, and press the small switch handle to the opposite position with a pointed tool. A DIP switch is said to be closed when its handle is toward the back of the printer. It is open when its handle is toward the front of the machine. Don't forget to turn the power back on when you are finished setting the switch.



Warning

Be sure to turn the power off before adjusting the switches. Don't use a pencil or pen to change a DIP switch setting; they can leave foreign matter behind, which eventually gets into the switch. A round toothpick works best.

Control Codes

The second and most common way to override the microprocessor rules, and the DIP switch settings as well, is to send special control codes from your computer. You'll want to use control codes for things such as printing boldface text, underlining, indenting, and so on. Each time your Apple Imagewriter receives a control code in the information your computer is sending, it pauses imperceptibly to intepret the code and follow its instructions; then it resumes printing.

There are two types of control codes: *control characters* and *control sequences*.

Control Characters

Some printer control codes consist of a single control character. A control character is a special character that is usually not displayed on your video screen and won't be printed as a character by your printer. A control character changes the nature of the character that follows it, like the way the SHIFT key makes lowercase letters into uppercase. For example, the L key produces the letter *L*, but sending a CONTROL-L tells the printer to stop printing on one page and space down to the top of the next page.

Control Sequences

Most printer control codes consist of an ESCAPE character followed by a sequence of characters. An ESCAPE character is similar to a control character: it changes the nature of the

characters that follow it. For example, an ESCAPE ! tells your printer to begin boldface printing.

By the Way: If the first character after an ESCAPE character is not a legitimate control code identifier, both it and the ESCAPE character will be ignored by the printer.

Because many standard Apple programs also use the ESCAPE character for special purposes (for instance, to leave a word processor program), it is often not possible simply to type an ESCAPE into *text files*.

Functions You Can Change

The remainder of this chapter lists and discusses printer functions you can change by resetting a DIP switch or sending a control code. Standard DIP switch settings are signified by all capitals: OPEN or CLOSED. Control codes are given in three forms:

- as one or more keyboard characters
- as a sequence of decimal values for the equivalent ASCII codes
- as a sequence of *hexadecimal* values for the equivalent ASCII codes

For a discussion of decimal and hexadecimal ASCII code equivalents, see Appendix C.

You don't need to understand what the decimal and hexidecimal numbers mean right now, but you may need to know about them later if you write your own programs or construct format files to send control codes to your printer.

For Experienced Users: Those parts of the control codes that consist of letters, numbers, punctuation marks, and other printing characters are easy to send to your printer. However, nonprinting control characters such as ESCAPE and TAB sometimes require special programming techniques. The easiest way to send nonprinting control characters to the printer is to include them in a normal output statement (such as a BASIC PRINT statement or a Pascal WRITE statement).

This has the disadvantage that the characters you type are not visible in your program listing. Worse yet, their presence will be detected by the Apple Imagewriter if you use it to print a copy of your source code, and they will be interpreted as printer control codes during the print-out.

One technique to avoid this problem is to create such characters as ESCAPE and TAB by means of CHR or CHR$ functions, although this requires longer program statements. The Pascal function CHR(nn) and the BASIC function CHR$(nn) both return the ASCII character that corresponds to the decimal number nn. For example, if nn is 27, the function returns an ESCAPE character. Thus, the control code to begin underlining, ESCAPE X, can be sent to the printer by the following statements:

```
(Pascal)        WRITE (PRINTER, CHR(27), 'X')
(BASIC)         PRINT#1 CHR$(27);"X"
```

Basic format shown is under ProDOS

The procedures for creating graphics and custom characters with the Apple Imagewriter (discussed in Chapter 4, Advanced Control Codes) often require that you send the printer ASCII characters containing specific bit patterns. The methods just described are valuable here.

Hexadecimal and Binary Numbers: A *binary* number is a sequence of zeros or ones. Every letter, symbol, or command sent to your Apple computer from the keyboard is first converted into an eight-*bit* binary number. For example, capital X becomes 01011000; the ESCAPE character becomes 00011011. This listing of correspondences between characters and binary numbers is called ASCII.

But eight-bit binary numbers are lengthy and difficult for most humans to read and write; so they are usually changed into two-digit hexadecimal numbers that are easier to use. Hex numbers use the 10 ordinary (decimal) numerals to represent 0 through 9, plus the capital letters A through F to represent 10 through 15. Each hex digit represents four binary digits:

Table 3-1. Hexadecimal and Binary Equivalents.

Hex	Binary	Hex	Binary	Hex	Binary	Hex	Binary
0	0000	4	0100	8	1000	C	1100
1	0001	5	0101	9	1001	D	1101
2	0010	6	0110	A	1010	E	1110
3	0011	7	0111	B	1011	F	1111

Thus to convert an eight-bit binary number into a two-digit hex number, simply replace the first four bits with the corresponding hex digit and the last four bits with the corresponding hex digit.
1A = 00011010

Hexadecimal numbers are often designated by preceding the digits with a dollar sign ($); for example: $1A

Baud Settings

Your Apple Imagewriter can receive data at 300, 1200, 2400, and 9600 baud (bits per second). DIP switches 2-1 and 2-2 specify the baud setting in effect when you turn on the printer. Both switches normally are closed, and the baud setting is 9600.

Switch 2-1	Switch 2-2	Baud Setting
Open	Open	300
Closed	Open	1200
Open	Closed	2400
CLOSED	CLOSED	9600

Serial Interface Protocol

See Appendix F for further discussion of interface specifications.

Your printer can receive data in two different types of protocol: XON/XOFF or Data Terminal Ready. DIP switch 2-3 specifies the protocol type when you turn on the printer. Switch 2-3 normally is open and Data Terminal Ready is the data protocol.

Switch 2-3	Data Protocol Type
OPEN	Data Terminal Ready
Closed	XON/XOFF

Character Pitch

If you would like to see how type looks in these different pitches, refer to Appendix D, Character Specifications.

Any of these character pitches can be printed in boldface or headline style.

With the Apple Imagewriter you can print characters in eight different widths, from 9 per inch to 17 per inch. Two of these options print proportionally, with the width selected to suit each character (for instance, *m* wider than *i*). Here are the control codes for each of the eight options:

Code	Decimal		Hex		Effect
ESCAPE n	27	110	$1B	$6E	Extended (9 characters per inch)
ESCAPE N	27	78	$1B	$4E	Pica (10 characters per inch)
ESCAPE E	27	69	$1B	$45	Elite (12 characters per inch)
ESCAPE p	27	112	$1B	$70	Pica proportional (144 dots per inch)
ESCAPE P	27	80	$1B	$50	Elite proportional (160 dots per inch)
ESCAPE e	27	101	$1B	$65	Semicondensed (13.4 characters per inch)
ESCAPE q	27	113	$1B	$71	Condensed (15 characters per inch)
ESCAPE Q	27	81	$1B	$51	Ultracondensed (17 characters per inch)

Each character pitch establishes a different rate of horizontal dot spacing, as shown below:

Pitch	Approximate Dots per Inch	Approximate Dots per 8" Line
Extended (9 characters per inch)	72	576
Pica (10 characters per inch)	80	640
Elite (12 characters per inch)	96	768
Pica proportional	144	1152
Elite proportional	160	1280
Semicondensed (13.4 characters per inch)	107	856
Condensed (15 characters per inch)	120	960
Ultracondensed (17 characters per inch)	136	1088

The settings of DIP switches SW 1-6 and SW 1-7 specify the character pitch in effect when you turn on the printer. Switch SW 1-6 normally is closed, and switch SW 1-7 open, so that the character pitch selected is elite. Recall that control codes override DIP switch settings.

Switch 1-6	Switch 1-7	Character Pitch
Open	Open	Pica
CLOSED	OPEN	Elite
Open	Closed	Ultracondensed
Closed	Closed	Elite proportional

Proportional Character Spacing

When your Apple Imagewriter is printing in a proportional pitch (selected by the ESCAPE P or ESCAPE p control codes), you can also specify how much space will be left between characters. One dot-width between characters is standard. With the following ESCAPE codes you can set spacing between characters from zero to nine dots in both proportional pitches. In elite proportional, you can add one to six dots of space between selected characters.

Code	Decimal	Hex	Effect
ESCAPE s n	27 115 d	$1B $73 $h	Sets spacing between all characters in proportional modes (n = 0 to 9)
ESCAPE n	27 d	$1B $h	Adds n dots of space between selected characters (n = 1 to 6) Available in elite proportional only

The numbers such as "n" and "c" in the **Code** column each represent an ASCII character or digit; each "d" in the decimal column is the decimal number assigned to each ASCII character or digit; and each "h" is the HEX equivalent of each "d".

Remember: These control codes work only in proportional character pitches (elite proportional and pica proportional). If you wish to use them with any other character pitch, you'll have to precede each character-spacing control code with an ESCAPE P code and follow it with the appropriate control code to return to the pitch you are using.

Character-spacing control codes are used primarily in programs that print justified text (text with both left and right margins straight, like text in a newspaper) by distributing the extra space in each line among the text characters.

Character Repetition

You can send a single control code to the Apple Imagewriter that will cause it to print the same character up to 999 times. The control code is six characters long:

Code	Decimal	Hex	Effect
ESCAPE R nnn c	27 82 ddd d	$1B $52 hhh h	Prints nnn repetitions of character c

For example, the following control code will cause 24 asterisks to be printed one after another:

ESCAPE R024*

The number nnn in this control code must always be three digits long; however, *leading zeros* may be replaced by spaces.

By the Way: If the number nnn is so large that the repeated characters run beyond the end of the line. The buffer overflow must be enabled to produce a line feed; otherwise the excess characters will print over other characters on the same line (see Buffer Overflow Action, in Chapter 4, Advanced Control Codes).

Slashed and Unslashed Zeros

Some people prefer to print the numeral zero with a slash through it (Ø) to distinguish it from the capital letter *O*. The Apple Imagewriter can print zeros either way, but normally prints them unslashed.

You can use the following control codes to change the way that zeros are printed:

Code	Decimal	Hex	Effect
ESCAPE Z CONTROL-@ CONTROL-A	27 90 0 1	$1B $5A $00 $01	Prints unslashed zeros
ESCAPE D CONTROL-@ CONTROL-A	27 68 0 1	$1B $44 $00 $01	Prints slashed zeros

Alternate (National) Characters

Your Apple Imagewriter has seven different language fonts to aid in printing text in German, French, Italian, Swedish, Spanish, and British English, as well as American English. You can choose any one of these character groups to substitute for these ten American symbols:



The table below illustrates the characters in each foreign language font.

Table 3-2. *Alternate Language Characters*

Language	Alternate Characters									
American	#	@	[	\	]	^	{	|	}	~
British	£	@	[	\	]	^	{	|	}	~
German	#	§	Ä	Ö	Ü	^	ä	ö	ü	ß
French	£	à	°	ç	§	^	é	ù	è	¨
Swedish	#	@	Ä	Ö	Å	^	ä	ö	å	~
Italian	£	§	°	ç	é	ù	à	ò	è	ì
Spanish	£	§	¡	Ñ	¿	^	°	ñ	ç	~
	$23	$40	$5B	$5C	$5D	$60	$7B	$7C	$7D	$7E

Note: For Spanish hyphen use single quote key ' ($27). The "$" (Hex $24) and "^" (Hex $5E) are part of the standard font in all languages.

In this table, the top and bottom lines show the American characters. The other lines give the alternate character groups that can be substituted for these characters by using the appropriate control codes. DIP switches SW 1-1, SW 1-2, and SW 1-3 specify the standard character group. The table below shows what control codes and combinations of positions of the three DIP switches provide the alternate character groups available. Note that there are two different sets of DIP switch settings and two different control codes that produce American symbols; you can use either one as the effects of both are the same.

Language Font	Code	DIP Switches 1-1	1-2	1-3
American	ESC Z CNTRL-G CNTRL-@	OPEN	OPEN	OPEN
British	ESC Z CNTRL-D CNTRL-@ ESC D CNTRL-C CNTRL-@	Closed	Closed	Open
German	ESC Z CNTRL-C CNTRL-@ ESC D CNTRL-D CNTRL-@	Open	Open	Closed
French	ESC Z CNTRL-A CNTRL-@ ESC D CNTRL-F CNTRL-@	Open	Closed	Closed
Swedish	ESC Z CNTRL-B CNTRL-@ ESC D CNTRL-E CNTRL-@	Closed	Open	Closed
Italian	ESC Z CNTRL-F CNTRL-@ ESC D CNTRL-A CNTRL-@	Closed	Open	Open
Spanish	ESC D CNTRL-G CNTRL-@	Closed	Closed	Closed
American	ESC Z CNTRL-E CNTRL-@ ESC D CNTRL-B CNTRL-@	Open	Closed	Open

You should set DIP switches SW 1-1, SW 1-2, and SW 1-3 to the character group you will normally use; this will cause that group to be chosen every time you turn on your Apple Imagewriter. When you wish to switch to another group while printing text, you can use the control codes to do so. For example, the following sequence will print a British pound sign even though your American character group has been selected by DIP switch settings:

```
ESC Z CNTRL-D CNTRL-@ ESC D CNTRL-C CNTRL-@  # ESC Z CNTRL-G CNTRL-@
```

If you would like to see exactly how the alternate language characters are printed in both fixed-width and proportional fonts, refer to Applendix D, Character Specifications.

You can choose only one complete alternate group at a time—only one line from the previous table. Once you have chosen an alternate group, the ten special symbols will always print the alternate characters of that group until you choose a different font.

Backspacing

You can print any two characters on top of one another by sending the printer a backspace control code between them:

Code	Decimal	Hex	Effect
CONTROL-H c	8 d	$08 h	Backspaces one character and prints the character c

This is handy for printing certain symbols, such as the plus-or-minus sign or the cents sign (c with a vertical bar through it). You

can use only one CONTROL-H at a time. If you wish to backspace repeatedly (for example, to print a line with slashes through every character) you must follow each character with CONTROL-H plus the overprinted symbol.

By the Way: Many *editor* programs have their own responses to CONTROL-H, which may prevent you from entering it directly into a text file.

Underlining

The Apple Imagewriter recognizes a pair of control codes to start and end underlining:

Code	Decimal	Hex	Effect
ESCAPE X	27 88	$1B $58	Starts underlining text
ESCAPE Y	27 89	$1B $59	Stops underlining text

Your printer underlines characters by printing the bottom dot in the type head. Thus underlining does not require double striking of characters, nor does it affect printing speed. When an ESCAPE X control code is in force, all text is underlined, including spaces and punctuation. You can underline with boldface printing (see below), and with all character pitches, including headlines (see Headline Type).

Boldface Printing

The Apple Imagewriter creates boldface characters by printing the character twice with a small shift of position. There are two control codes for this function, one to start boldface printing and the other to end it.

Code	Decimal	Hex	Effect
ESCAPE !	27 33	$1B $21	Starts boldface printing
ESCAPE "	27 34	$1B $22	Ends boldface printing

Boldface printing will darken all characters in all character pitches, including headlines. If you use it with underlining, it will increase the darkness of the underline as well as of the character. The printer runs at a slower speed during boldface printing.

Headline Type

Your printer can print double-width boldface characters, which make excellent headlines. To start or end double-width printing, use the following control codes:

Code	Decimal	Hex	Effect
CONTROL-N	14	$0E	Begins headline mode
CONTROL-O	15	$0F	Returns to normal mode

You can print headlines in conjunction with all of the character pitch options listed previously; the dot spacing remains the same, but you get half as many characters per inch. Thus you can select from eight giant typefaces, ranging from 4.5 characters per inch (extended) to 8.5 characters per inch (ultracondensed).

Direction of Type Head Motion

You can print lines either solely from left to right (like a typewriter), or back and forth. Since printing in both directions is slightly faster, you will usually want to use bidirectional printing. When printing certain patterns with graphics control codes, however, you may prefer one-direction printing because it improves the quality. You will also want to use one-direction printing for reports containing columns, when close alignment of the columns is important.

To control the printing direction, use the following control codes:

Code	Decimal	Hex	Effect
ESCAPE >	27 62	$1B $3E	Left-to-right printing only
ESCAPE <	27 60	$1B $3C	Bidirectional printing

Each of these control codes remains in force until canceled by the other.

Line Feed Function

In the standard mode any line feed causes the printer to execute a carriage return, and then print the next line of characters starting at the left margin:

_____(LF)

If you enable the optional line feed function, a line feed does not cause the printer to execute a carriage return; the next line of type starts directly below where the previous line left off:

_____(LF)

_____

The codes for enabling and disabling the line feed function are as follows:

Code	Decimal	Hex	Effect
ESCAPE I 1	27 108 49	$1B $6C $31	Enables optional line feed function
ESCAPE I 0	27 108 48	$1B $6C $30	Disables optional line feed function

Automatic Line Feed

Many standard programs that create text files automatically add a line feed after every carriage return that they send. Others offer this feature as an option.

If the program that prepares text for your printer sends only a carriage return character to start a new line, you can cause the printer to add the line feed by itself. If SW 1-8 is closed, a line feed will be added after every carriage return. If SW 1-8 is open, no line feed will be added.

If the program already adds a line feed, you can add an automatic line feed to produce double-spaced printing.

You can also use the following control codes to control automatic line feeds:

Code	Decimal	Hex	Effect
ESCAPE D {@} CONTROL-@	27 68 128 0	$1B $44 $80 $00	Adds automatic line feed
ESCAPE Z {@} CONTROL-@	27 90 128 0	$1B $5A $80 $00	No line feed added

Note: The {@} in these two codes stands for a *high ASCII* CONTROL-@ (decimal 128, hex $80). This command can't be accessed through AppleSoft BASIC.

Line Feed Pitch

When the printer is turned on, it selects by default a vertical line spacing of six lines to the inch. At any time you can change this to eight lines per inch with a single control code:

Code	Decimal	Hex	Effect
ESCAPE A	27 65	$1B $41	6 lines per inch
ESCAPE B	27 66	$1B $42	8 lines per inch

In addition to these two pitches, you can select any line spacing, in increments of 1/144 of an inch, from 1/144 up to 99/144 of an inch:

Code	Decimal	Hex	Effect
ESCAPE T nn	27 84 dd	$1B $54 hh	Distance between lines to be nn/144 inch (nn = 01 to 99)

These three codes affect subsequent end-of-line actions; they do not affect the placement of the line in which they are included. They remain in effect until you set a new line feed pitch, or until you turn the power off.

The vertical distance between dots is approximately 1/72 of an inch, so this control code permits line feeding to be as little as one-half of a dot dimension. Although the control code ESCAPE T00 is ignored, the control code ESCAPE T01 can be used to feed the paper an imperceptible amount. This is handy if you want to overprint one line of text with another.

The control code ESCAPE T18 establishes a line feed pitch of eight to the inch (144 divided by 18 is 8), and ESCAPE T24, one of six to the inch (144 divided by 24 is 6). If you wish to print graphics, change the control code to ESCAPE T16, which enables you to place one vertical line of dots directly beneath another and thereby draw a continuous vertical line.

By the Way: If you change the line feed pitch, it will change the number of inches of paper fed by each press of the FORM FEED button. Thus you must also adjust the number of lines per page if you still want form feed to advance the paper to the top of the next page (see Page Length, described later in this chapter).

Line Feed Direction

Paper can feed backward or forward through the printer, in response to these control codes:

Code	Decimal	Hex	Effect
ESCAPE f	27 102	$1B $66	Forward (normal) line feeding
ESCAPE r	27 114	$1B $72	Reverse line feeding

The printer will continue to feed in the direction last selected until it receives the opposite control code. Every time you turn the power on, forward line feeding is automatically selected.

Multiple Line Feeding

You can issue a single control code to make your Apple Imagewriter feed as many as 15 blank lines at once. This control code will work in both forward and reverse line feed directions, and with any line feed pitch:

Code	Decimal	Hex	Effect
CONTROL-_ n	31 d	$1F h	Feeds n lines of blank paper (n = 1,2,3,4,5,6,7,8,9,:[10],;[11], <[12],=[13],>[14],?[15])

Note that CONTROL-_ is CONTROL-underline, and that for 10 to 15 lines, you use symbols rather than numbers for n in the control code.

Left Margin Setting

When you turn the power on, your Apple Imagewriter starts each line of print as far left as the type head can travel. This is called position 0 (not 1), and corresponds physically to the red ring engraved at the left end of the roller shaft. However, you can change the left print margin at any time by sending the printer this five-character control code:

Code	Decimal	Hex	Effect
ESCAPE L nnn	27 76 ddd	$1B $4C hhh	Sets left margin to position nnn

For example, the following control code advances the left margin to the 36th character position:

ESCAPE L035

Similarly, the control code ESCAPE L000 moves the left margin back to the far left end. The left margin remains at the selected setting until another ESCAPE L control code is sent to the printer, or until the power is turned off.

Although the number nnn must always contain three digits, you can replace leading zeros with spaces if desired.

Note that the position of the margin, which is measured by counting characters, depends on the character pitch in force at th time the margin control code is sent. If you subsequently change the character pitch, the margin will not move to accommodate th change.

By the Way: If elite proportional pitch is in force, the margin will be measured at 10 character positions to the inch; with pica proportiona it will be measured at 9 to the inch.

Page Length

The FORM FEED button in the Apple Imagewriter control cluster advances the paper to the top of the next page. The distance advanced can be either 66 or 72 lines. If SW 1-4 is open, there are 66 lines per page. If SW 1-4 is closed, there are 72 lines per page.

You can decrease the number of lines per page, set by DIP switch SW 1-4, by sending the printer a vertical tabbing control code. This is explained under Vertical Tabbing in Chapter 4, Advanced Control Codes.

Note that the distance the paper advances is based on the number of printed lines; if you change the line feed pitch, the page length changes accordingly. Thus, a page of 66 lines turns out to be 11 inches long only if the line feed pitch is set to 6 lines per inch.

Form Feeding

You can send a control code to your Apple Imagewriter that has the same effect as pressing the FORM FEED button in the control cluster:

Code	Decimal	Hex	Effect
CONTROL-L	12	$0C	Feeds paper to next top of form

This code also signals an end-of-line, causing the printer to print all text in the buffer.

Top of Form Set Command

You can electronically set the top of form (TOF) at any point on the page by sending the following control code:

Code	Decimal	Hex	Effect
ESCAPE v	27 118	$1B $76	Sets TOF to current position

Paper Error Detector

The paper error detector monitors the amount of paper remaining in the printer. When less than one inch remains, the PAPER ERROR light lights, and the printer is deselected. You can use these control codes to nullify the paper error detector if you wish:

Code	Decimal	Hex	Effect
ESCAPE O	27 79	$1B $4F	Paper error detector off
ESCAPE o	27 111	$1B $6F	Paper error detector on

Restoring Standard Instructions

You can restore the printer to its standard instructions at any time, by using the ESCAPE c control code:

Code	Decimal	Hex	Effect
ESCAPE c	27 99	$1B $63	Restores standard instructions (Software Reset)

When you issue an ESCAPE c control code, the printer prints all data entered prior to the ESCAPE c, restores all operating instructions (except for vertical tab settings) to the power-on state specified by the DIP switches and microprocessor, and is left selected.

Chapter 4 Advanced Control Codes

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Once you have become familiar with the control codes described in the preceding chapter, read this chapter to learn how to use even more sophisticated control codes.

The Input Buffer

The text sent to your printer is stored in a *buffer* and isn't printed until the buffer is full, or until the printer receives an *end-of-line character.* The buffer can accept a maximum of about 1000 characters.

End-of-Line Character

The end-of-line character is normally a carriage return (CR). However, if you like, you can specify that carriage return, line feed (LF), vertical tab (VT), and form feed (FF) all be recognized as end-of-line characters. Use the following control codes to change the end-of-line character:

Code	Decimal	Hex	Effect
ESCAPE Z@ CONTROL-@	27 90 64 0	$1B $5A $40 $00	CR only
ESCAPE D@ CONTROL-@	27 68 64 0	$1B $44 $40 $00	CR, LF, VT, FF

Canceling Text

If you have text in the printer's input buffer—in other words, text that has been sent to your Apple Imagewriter but not yet printed—you can erase it from the buffer with the following control code:

Code	Decimal	Hex	Effect
CONTROL-X	24	$18	Cancels all unprinted text

CONTROL-X does not cancel control codes; it cancels only ordinary text.

Buffer Overflow Action

When the buffer becomes full, it automatically prints its contents. At this time the printer may or may not feed a line of paper. Normally the printer does feed a line of paper when the buffer is full, but you can use the following control codes to change the buffer overflow action:

Code	Decimal	Hex	Effect
ESCAPE Z_ CONTROL-@	27 90 32 0	$1B $5A $20 $00	No line feed added
ESCAPE D_ CONTROL-@	27 68 32 0	$1B $44 $20 $00	Line feed added

Note: The underline (_) in ESCAPE Z_ above is used to indicate a space character (ASCII character 32).

Data Byte Length

Your Apple computer sends text to the printer in eight-bit data *bytes.* Normal ASCII characters use only the lower seven bits, so usually the highest value bit is ignored. Thus, it usually does not matter whether or not your Apple Imagewriter processes the eighth (highest value) bit of data it receives.

However, certain control codes require characters in which the eighth bit is set. For this reason, a control code is provided to allow you to choose whether or not to recognize the eighth bit. If SW 1-5 is open, the eighth bit is recognized. If SW 1-5 is closed, the eighth bit is ignored.

For most uses of your Imagewriter, SW 1-5 should be kept closed, so that the Imagewriter will accept characters with the eighth bit set high, as in AppleSoft BACIC.

You can also use the following control codes to change the data byte length; although they are not applicable to AppleSoft BASIC.

Code	Decimal	Hex	Effect
ESCAPE D CONTROL-@_	27 68 00 32	$1B $44 $00 $20	Ignores eighth bit
ESCAPE Z CONTROL-@_	27 90 00 32	$1B $5A $00 $20	Recognizes eighth bit

Note: The underline (_) is used to indicate a space character.

Horizontal Tabbing

You can set up to 32 horizontal tab positions for your Apple Imagewriter. Each tab character (TAB or CONTROL-I) sent to the printer advances the type head to the next tab position. The printer ignores tab characters if no tab positions have been set or if the type head is at or beyond the last tab position. Control codes can be used to clear tab positions individually or all at once. Turning off the printer also clears all tab positions.

Here are the codes you use:

Note: Before using ESCAPE u, refer to Appendix G for firmware modifications applicable to your Apple Imagewriter.

Code	Decimal	Hex	Effect
ESCAPE (a,b, ...	27 40 d1 44 d2 44 ... 46	$1B $28 h1 $2C h2 $2C ... $2E	Sets horizontal tab line (a,b,etc. = three-digit numerals)
ESCAPE u	27 117	$1B $75	Sets selected tab
CONTROL-I	9	$09	Moves type head to next tab
ESCAPE)a,b, ...	27 41 d1 44 d2 44 ... 46	$1B $29 h1 $2C h2 $2C ... $2E	Clears selected tabs (a,b,etc. = three-digit numerals)
ESCAPE 0	27 48	$1B $30	Clears all tabs

Setting a Tab Line

To set a line of horizontal tab positions, you send an ESCAPE character, a left parenthesis, and a sequence of three-digit ASCII numerals (normal keyboard characters). You send the numerals to the printer in ascending numerical order, separate them by

commas, and end them with a period. The numbers specify the character positions, starting from the left margin, where tabs will be set. The left margin is position 1. For example,

ESCAPE(005,023,067.

sets tabs at character positions 5, 23, and 67. You can replace leading zeros with spaces.

The character pitch determines the maximum horizontal tab setting:

Character Pitch	Maximum Horizontal Tab Setting
Extended	72
Pica	80
Elite	96
Pica proportional	72
Elite proportional	80
Semicondensed	107
Condensed	120
Ultracondensed	136

Tab positions are based on the character pitch in force at the time you enter the horizontal tab line. If you later change the character pitch, the tabs will remain in the same absolute locations and will no longer correspond to actual character positions. If tabs are set while proportional pitch is in force, they will be based on a pitch of 10 characters per inch.

You specify tab positions relative to the current position of the left margin. If you change the left margin after setting the tabs, the tab positions will not change to correspond to the new margin.

Remember: When you combine margin settings with tab settings, the margin positions start with 0, while the tab positions start with 1. Thus, for example, a margin setting of 5 will start each line at the same place as a tab setting of 6.

Adding a Selected Tab

In addition to the original tab setup you can add a selected tab by sending a control code. Only one tab can be added at a time. The original tab settings are maintained and the new one added.

Code	Decimal	Hex	Effect
ESCAPE u	27 117	$1B $75	Sets horizontal tab in addition to those already set (only one additional tab can be set at a time)

Using Horizontal Tabs

To move the type head to the next tab position, send a CONTROL-I. This character is sometimes called the ASCII HT command. A string of several CONTROL-I characters will cause the type head to jump over tabs to the position desired, as with a typewriter.

Many text editor programs have their own horizontal tabbing facilities, which use a TAB character or CONTROL-I. If you are using one of these programs, you will not be able to enter CONTROL-I directly into your file.

Clearing Horizontal Tabs

Although you must initially set horizontal tabs one entire line at a time, you can clear them individually. The clearing command is identical to the setting command, except that a right parenthesis, instead of a left parenthesis, follows the ESCAPE character. An ESCAPE character followed by a zero clears all tabs. If you attempt to clear a tab that is not set, you won't affect the rest of the command; but bad syntax will cause the whole command to be ignored.

Vertical Tabbing

The Apple Imagewriter's microprocessor contains a memory called an *Electronic Vertical Form Unit* (or EVFU) that keeps track of up to 96 vertical tab positions on a page. To set vertical tabs, you send the printer control codes that specify the top and bottom of the page, and control codes that specify whether to set tab stops or not for each line in between. You can set tabs on each line for up to five different pages.

After you set the vertical tabs, you refer to the tab positions by sending vertical tab control codes to the printer. As usual, a form feed control code causes an advance to the next top of form. This powerful facility allows you to create up to five separate vertical tabbing patterns simultaneously, thus permitting up to five separate forms to be run without your having to reset the tabs for each form.

Setting Vertical Tabs

To set a structure of vertical tabs, send a top of form (TOF) control code, control codes for vertical tab positions, a bottom of form (BOF) control code, and a control code for the next TOF. The distance between the two TOF settings corresponds to the page length. The TOF is not necessarily the physical top of the paper. The following table shows the three control codes for setting the TOF and BOF:

Code	Decimal	Hexadecimal	Effect
CONTROL-] A@	29 65 64	$1D $41 $40	Sets top of form (TOF)
C@	67 64	$43 $40	Sets bottom of form (BOF)
A@ CONTROL-	65 64 30	$41 $40 $1E	Sets TOF—next form

Between the first two control codes, you enter up to 95 two-character codes to specify either a tab stop or no stop for each line between the TOF and BOF. Tab stops for the first page are labeled B, for the second C, for the third D, for the fourth E, and for the fifth F. Any line can have tab stops for any combination of the five pages. The following table lists all the possible codes:

Code	Decimal	Hex	Effect
@@	64 64	$40 $40	Sets no tabs
B@	66 64	$42 $40	Sets tab B
D@	68 64	$44 $40	Sets tab C
H@	72 64	$48 $40	Sets tab D
P@	80 64	$50 $40	Sets tab E
`@	96 64	$60 $40	Sets tab F
F@	70 64	$46 $40	Sets tabs B, C
J@	74 64	$4A $40	Sets tabs B, D
R@	82 64	$52 $40	Sets tabs B, E

Code	Decimal	Hex	Effect
b@	98 64	$62 $40	Sets tabs B, F
L@	76 64	$4C $40	Sets tabs C, D
T@	84 64	$54 $40	Sets tabs C, E
d@	100 64	$64 $40	Sets tabs C, F
X@	88 64	$58 $40	Sets tabs D, E
h@	104 64	$68 $40	Sets tabs D, F
p@	112 64	$70 $40	Sets tabs E, F
N@	78 64	$4E $40	Sets tabs B, C, D
V@	86 64	$56 $40	Sets tabs B, C, E
f@	102 64	$66 $40	Sets tabs B, C, F
Z@	90 64	$5A $40	Sets tabs B, D, E
j@	106 64	$6A $40	Sets tabs B, D, F
r@	114 64	$72 $40	Sets tabs B, E, F
\@	92 64	$5C $40	Sets tabs C, D, E
l@	108 64	$6C $40	Sets tabs C, D, F
t@	116 64	$74 $40	Sets tabs C, E, F
x@	120 64	$78 $40	Sets tabs D, E, F
	94 64	$5E $40	Sets tabs B, C, D, E
n@	110 64	$6E $40	Sets tabs B, C, D, F
v@	118 64	$76 $40	Sets tabs B, C, E, F
z@	122 64	$7A $40	Sets tabs B, D, E, F
|@	124 64	$7C $40	Sets tabs C, D, E, F
~@	126 64	$7E $40	Sets tabs B, C, D, E, F

Between the BOF control code and the TOF control code for the next page, you must enter enough two-character "no tab" codes (@@) to fill out the remaining page length. For example, suppose you are printing a 36-line form on fanfold paper with pages 66 lines

long. You send control codes to form a vertical tab structure such as the following:

Line 1: Starting TOF code
Line 2:
___ } 34 tab-setting or "no tab" codes
Line 35:
Line 36: BOF code
Line 37:
___ } 30 "no tab" codes
Line 66.
Line 67: Next TOF code

You send the 136 characters required to create this structure to the printer in an uninterrupted stream, without spaces or carriage returns (although you can end the whole sequence with a carriage return). For this reason, setting them up in a format file (see Creating a Format File) or generating them by executing a program is safer than trying to enter them directly from the keyboard.

Using Vertical Tabs

Once you have sent a vertical tab structure to your Apple Imagewriter, you can use it as long as you don't turn the power off. To use the tab positions you have set, send the following control codes to the printer:

Code	Decimal	Hex	Effect
CONTROL-_ B	31 66	$1F $42	Drops to next line with tab B
CONTROL-_ C	31 67	$1F $43	Drops to next line with tab C
CONTROL-_ D	31 68	$1F $44	Drops to next line with tab D
CONTROL-_ E	31 69	$1F $45	Drops to next line with tab E
CONTROL-_ F	31 70	$1F $46	Drops to next line with tab F
CONTROL-_ A	31 65	$1F $41	Drops to next BOF or TOF
CONTROL-L	12	$0C	Drops to next TOF

Note that CONTROL-_ is CONTROL-underline.

Here is an example that illustrates the use of vertical tabs. Suppose you have a form 12 lines long with 10 lines of text. Let's say you wish to set the following tabs:

Line 1: TOF
Line 2: No tabs
Line 3: Tab B
Line 4: Tab C
Line 5: No tabs
Line 6: Tabs B and D
Line 7: Tabs C and D
Line 8: No tabs
Line 9: Tab E
Line 10: BOF
Line 11:
Line 12:
Line 13: TOF, next form

To send these vertical tab positions to your Apple Imagewriter, you use the following control codes:

CONTROL-] A@ @@ B@ D@ @@ J@ L@ @@ P@ C@ @@ @@ A@ CONTROL-

(The spaces in the previous line have been inserted for clarity; you shouldn't put spaces in the actual control code.)

Then, if you send a CONTROL-_ followed by a tab letter, the paper advances to the next line for which that tab has been set. From line 1, for instance, the control code CONTROL-_ C causes an advance to line 4; two CONTROL-_ B control codes in succession cause an advance to line 6; and so on. A CONTROL-_ A control code advances paper to the next BOF or TOF, whichever comes first. A CONTROL-L advances paper to the next form feed.

By the Way: If you reverse the line feed direction (see Chapter 3, Controlling Your Printer) the vertical tab structure will still function, but it will be inverted with respect to the paper. For instance, a tab B on the first line will be the second tab position from the right on the last line.

When using vertical tabbing control codes, you will find it helpful to remember these tips.

Vertical tabbing works by counting lines. This means that the distance in inches between tab positions depends on the line feed pitch. If you change the pitch after the tabs have been set, the whole format expands or contracts accordingly. Since you can select any pitch from 1/144 to 99/144 of an inch in increments of 1/144 of an inch, you can tailor your printing to virtually any

physical page format. If necessary, you can change line feed pitches within a form to place the printing exactly where you want it.

The maximum number of lines for which you can store vertical tab information is either 66 or 72, depending on the setting of DIP switch 1-4. If you attempt to set more lines than this, the extra commands will be ignored.

Be careful how you set the TOF and BOF. If you don't set them correctly, your vertical tabs will not work.

An illegal tab command (such as an attempt to go to a tab not present in the rest of the structure) advances the paper to the BOF line. You cannot go from a tab position within one form to a tab position within the next; you must go to the next TOF first.

Setting Page Length

Even if you do not use the vertical tab commands, you may wish to use the vertical tab control codes to set the maximum length of each printed page (maximum length = 96 lines). Text fills the page until it reaches the line identified as the BOF. After the BOF line is completed, the printer advances paper to the next TOF line before printing any more.

For example, suppose you wish to print out a file of continuous text in the form of 60-line pages printed on fanfold paper that is 66 lines long. You enter the following vertical tab control codes:

CONTROL-] A@ <58 @@ codes> C@ <6 @@ codes> A@ CONTROL-

(The spaces in the previous line have been inserted for clarity; you shouldn't put spaces in the actual control code.)

As you load paper into the printer, set the top of the page to three lines below the perforations between pages. Your text will be printed in 60-line blocks, each block centered vertically on the 66-line page.

Vertical Tab Reset and Default

When you turn your Apple Imagewriter on, the print length (TOF to BOF) and page length (TOF to TOF) are both either 66 or 72 lines,

depending on the setting of DIP switch SW 1-4. Each page contains a B tab every six lines, and no others.

The default condition can also be electronically reset by sending the following control characters. These characters set the vertical tabs to power-on status and reset TOF to the current position on the page.

Code	Decimal	Hex	Effect
GS 0	29 48	$1D $30	Sets vertical tabbing to power-on status, and sets TOF to current position

Custom Characters

Tired of using ordinary letters and numbers? The Apple Imagewriter lets you design your own alphabet! It contains a special memory that is capable of holding up to 175 custom-designed characters. Control codes allow you to switch the entire Apple character set from normal characters to new ones you have designed, and back again. You can easily mix custom symbols with ordinary text. Your custom-designed characters act just like the others: they expand and contract with changes in character pitch; you can underline them, print them in boldface, and expand them into headlines.

To use this capability, you need to understand how to create new characters, how to load them into your Apple Imagewriter's memory, and how to fetch them from memory and print them. We will discuss each of these phases separately, and then illustrate them with a specific example.

Creating Custom Characters

The dot-matrix type head contains a vertical array of nine dot-strikers (called wires), spaced 1/72 of an inch apart. Normal characters are printed by striking up to seven patterns in a row, with the eighth pattern left blank to separate the characters. The fixed-width alphabets (pica, extended, condensed, and so on) print all characters eight dots wide; the proportional alphabets vary the number of dots per character to fit the width of each letter or symbol. The difference between one character pitch and another is not in the number of dots per chacacter, but in their horizontal

spacing. Thus an ultracondensed *A* is printed with the same dot pattern as a pica *A*, but with 136 dots to the horizontal inch instead of 80.

Custom characters are able to go beyond normal character limits, for they can be up to 16 dots wide. The width is defined for each individual character, and is either proportional or fixed. A custom character can be assigned to any keyboard position that normally prints something, including uppercase and lowercase characters.

The dot-striking wires in the type head are numbered from 1 at the top to 9 at the bottom. When designing a custom character you can use either the top eight wires (1 through 8) or the bottom eight wires (2 through 9). The normal alphabet uses wires 1 through 7 for capital letters and 3 through 7 for lowercase, with 8 and 9 being reserved for descenders, such as the tails on lowercase *y*, *g*, and *p*. Wire 9 is used for underlining as well. Thus the base line for normal printing is wire 7.

If you design each new custom character on square-ruled paper first, you can check its proportions and its vertical placement with respect to other characters. This also makes it easy to translate the dot pattern into a series of data bytes you send to your Apple Imagewriter. Each vertical column of dots translates into a binary number in which each bit set to 1 (for on) corresponds to a dot. The *least significant bit* (the last digit) of this number corresponds to the top of the character (wire 1 or 2, depending on whether the upper or lower eight wires are being used), and the *most significant bit* (the first digit) to the bottom. Specify spacing included with the character with one or more binary zero numbers (ASCII nulls). The example at the end of this section shows how to calculate these numbers when creating a new symbol.

Loading Custom Characters

As soon as you have designed a new custom character, you can load it into your Apple Imagewriter's memory. Following are the codes you use:

Code	Decimal	Hex	Effect
ESCAPE -	27 45	$1B $2D	Maximum width is 8 dots
ESCAPE +	27 43	$1B $2B	Maximum width is 16 dots
ESCAPE I	27 73	$1B $49	Starts loading new character(s)
CONTROL-D	4	$04	Ends new character(s) loading
A.....P	65...80	$41...$50	Width code when using top 8 wires (A = 1 ... P = 16)
a.....p	97..112	$61...$70	Width code when using bottom 8 wires (a = 1 ... p = 16)

To load one or more new custom characters into memory, follow these steps:

1. Select a maximum width of 8 or 16 dots by sending the printer either ESCAPE - or ESCAPE +. If you choose a maximum width of 16 dots, the memory can hold fewer characters than if you choose a maximum width of 8. The maximum width selection remains until it is canceled by the other control code or until you turn off the power.
2. Send the printer an ESCAPE I to tell it you are starting a group of new character specifications.
3. For each new character, send the following information to the printer:
   a. The regular character that is to be assigned a new symbol. This can be any uppercase or lowercase letter, any numeral, or any punctuation mark, including spaces. It may not be RETURN, ESCAPE, TAB, or any other nonprinting character. (If you select a maximum width of eight dots in step 1 above, you can also use 80 of the printing characters again with ASCII bit 8 set, for a total of 175 custom characters. See the explanation of the ESCAPE control code in Printing Custom Characters.)
   b. A width code from the preceding table. If the new character is seven dots wide (including spacing) and you want it printed using wires 1 through 8, send G; if it is 13 dots wide and uses wires 2 through 9, send m; and so on.
   c. As many eight-bit binary numbers (in the form of ASCII characters) as were specified by the width code just sent. Each binary number specifies a one-column dot pattern, from the left to the right. Bit 0 of each number corresponds to the top wire, and bit 7 corresponds to the bottom.

For a table of ASCII characters corresponding to binary numbers, see Appendix C.

4. After repeating step 3 for each custom character, send the printer a CONTROL-D character to signal that the loading sequence is complete.



Warning

Be careful when sending this sequence to the printer. If you get out of step by one character, the whole result can become garbled.

Printing Custom Characters

Once their specifications are stored in your Apple Imagewriter's memory, you can fetch and print custom characters at any time. The following codes switch the entire keyboard of printing characters from one font to another:

Code	Decimal	Hex	Effect
ESCAPE '	27 39	$1B $27	Switches to custom character font
ESCAPE *	27 42	$1B $2A	Switches to custom character font (high ASCII values)
ESCAPE $	27 36	$1B $24	Switches back to normal font

Whenever one of these control codes appears in text being printed, the printer changes fonts and continues to print with that font until it receives one of the other codes (or until you turn the power off, at which time it reverts to the normal font). Most of the time you will probably want to fetch a single custom symbol. To do this you send the printer ESCAPE ' (or ESCAPE *), the keyboard character to which the custom symbol was assigned, and ESCAPE $.

ESCAPE ' (ESCAPE accent grave) and ESCAPE * (ESCAPE asterisk) have the following different characteristics:

For a table of ASCII characters corresponding to binary numbers, see Appendix C.

- ESCAPE ' fetches custom characters in both 8-dot-maximum and 16-dot-maximum storage modes assigned to ordinary keyboard characters (including space)—ASCII characters with decimal values 32 through 126.
- ESCAPE ' also fetches custom characters assigned to ASCII characters with decimal values 160 through 191 (Not applicable to AppleSoft BASIC). These characters can't be more than eight dots wide and must have been stored in the eight-dot-maximum mode. When you use ESCAPE ' for this purpose, make sure that DIP switch SW 1-5 is open or an ESCAPE Z CONTROL-@__(__= space character) control code is in force (see Data Byte Length earlier in this chapter).

- ESCAPE * fetches custom characters assigned to ASCII characters with decimal values 160 through 239. In effect, it reassigns them to characters 128 lower—in other words, ASCII 32 through 111 (all of the normal keyboard characters except the punctuation marks {, |, }, and ~, and lowercase letters above o).

Since the ESCAPE ' control code permits you to change to a font containing up to 95 custom characters of any width (regardless of the position of DIP switch SW 1-5) and fetch them with ordinary keyboard characters, you will probably never need to use the ESCAPE * control code. However, it is available if you ever need to store and use as many as 175 custom characters up to eight dots wide.

A Sample Custom Character

Suppose you are using your Apple Imagewriter to print technical specifications in which the plus-or-minus sign (±) is used extensively. You could print this symbol by printing plus-backspace-underline (+/_), but the result would look awkward. A better solution is to use a custom character.

The first step is to design the new symbol on square-ruled paper, numbering the columns. It should look like this:

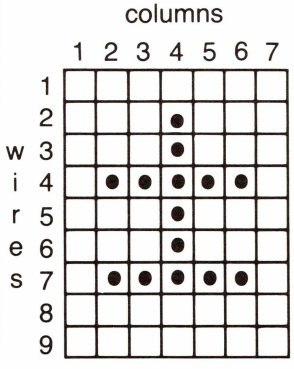


Figure 4-1. Designing a Custom Character

The next step is to translate the columns into binary numbers, and then into ASCII characters. The new symbol uses wires 1 through 8, so the least significant (or last) digit of each binary number corresponds to wire 1 and the most significant to wire 8. Looking at the layout on squared paper, it is easy to see that the first number consists entirely of zeros, the next has a 1 for the second and fifth digits (wires 7 and 4); and so on. By referring to Appendix C you can find out what ASCII characters correspond to these numbers. The following table shows the result:

Column	Binary	ASCII
1	00000000	NUL (CONTROL-@)
2	01001000	H
3	01001000	H
4	01111110	~
5	01001000	H
6	01001000	H
7	00000000	NUL (CONTROL-@)

Since the new symbol is only seven dots wide, you can enter it in the eight-dot maximum storage mode. Let's assume that you want to fetch it from the custom character font by using the *&* character. The resulting loading sequence is:

ESCAPE - ESCAPE I & G CONTROL-@ H H ^ H H CONTROL-@ CONTROL-D

Of course the spaces shown above are omitted from the actual sequence sent to the printer. The character *G* is the width code. It indicates that the top eight wires print the symbol and that it is seven dots wide (*G* is the seventh letter of the alphabet).

After you load the new character by means of the sequence above, you can print the character at any time by sending to the printer this sequence:

ESCAPE ' & ESCAPE $

These five characters change the printer's type style to the custom font, print the symbol assigned to the *&* key, and change it back to the normal font.

By the Way: Whenever you turn the power off, the entire memory of custom characters is lost. It is therefore a good idea to put your loading sequences into a format file, which you can send to the printer every time you turn the power on. (See Creating a Format File at the end of this chapter.)

Printing Graphics

You can make your Apple Imagewriter print a completely black page, consisting of 23,040 dots per square inch. While this is probably not something you want to do, it illustrates the printer's capability to create any graphics pattern up to eight inches wide and any length.

There are three primary ways to create graphics patterns with the Apple Imagewriter:

- by printing a line of many different vertical dot patterns, each up to eight dots high
- by repeating a single vertical dot pattern all the way across a line
- by the exact placement of single dots or small groups of dots at one or more positions along a line

In all cases, printed graphics are produced one line at a time. Each line can be up to 8 dots high and 1,280 dots long.

Column-Oriented Graphics

The Apple Imagewriter can print horizontal lines with dots in any pattern you desire. Each vertical column of up to eight dots is defined by a separate ASCII character, so a single line may require up to 1,280 characters (bytes) for its definition. After it prints each line, the printer is ready to receive a new line.

Each control code defining one horizontal line of dot graphics starts with one of the following:

Code	Decimal	Hex	Effect
ESCAPE G nnnn	27 71 dddd	$1B $47 hhhh	Prints line corresponding to the following nnnn data bytes
ESCAPE S nnnn	27 83 dddd	$1B $53 hhhh	Same as ESCAPE G
ESCAPE g nnn	27 103 ddd	$1B $67 hhh	Prints line corresponding to the following nnn x 8 data bytes

The numbers such as "n" and "c" in the **Code** column each represent an ASCII character or digit; each "d" in the decimal column is the decimal number assigned to each ASCII character or digit; and each "h" is the HEX equivalent of each "d".

The decimal number nnnn after the ESCAPE G consists of four ordinary keyboard numerals; it specifies the number of data bytes (up to 9999) that follow. This six-character prefix plus the data bytes themselves constitute the complete control code, which may thus run up to 10,005 characters.

ESCAPE S and ESCAPE G are identical and may be used interchangeably.

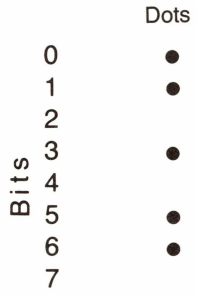
The decimal number nnn after the ESCAPE g consists of three keyboard numerals; it specifies the number of data bytes divided by eight (up to 999) that follow. ESCAPE g operates somewhat faster than ESCAPE G and ESCAPE S, but otherwise is the same; for example, ESCAPE g 010 and ESCAPE G 0080 are equivalent.

Remember: In this and other control codes, you can replace leading zeros with spaces.

Each of the data bytes defines a vertical column of eight dots printed by the type head. A dot is printed for each bit set to 1 in the data byte. Bit 7 causes the dot at the bottom of the column to be printed and bit 0 causes the dot at the top to be printed. For

example, the data byte (hex $6B, binary 01101011) causes a column of dots to be printed, as shown in the following figure:

Figure 4-2. Effect of Data Byte



The columns print from left to right, starting at the left margin of the page.

Data bytes are frequently nonprinting characters. Most graphics patterns, however, are generated by programs written for the specific purpose, in which case the data bytes are specified by Pascal CHR or BASIC CHR$ functions. (See A Graphics Example later in this chapter.)

Remember: CHR functions require base-10 numbers as arguments. If you design the bytes in binary or hexadecimal, you must convert to decimal before using CHR functions.

Dot Spacing

A table under Character Pitch in Chapter 3, Controlling Your Printer, shows the maximum number of dots per line for each of the eight character pitches.

The vertical spacing of the striker wires in the type head is approximately 1/72 of an inch. The horizontal character pitch that produces 72 dots per inch is extended, or nine characters per inch. So if you select a vertical line feed pitch of 16/144 of an inch, the result is a uniform matrix of dot positions—72 per inch in each direction, with a total density of 5,184 dots per square inch. The dot size is such that horizontal and vertical lines appear connected for this matrix. To produce nine characters per inch horizontally and a line feed pitch of 16/144 of an inch use

ESCAPE n ESCAPE T16

A Graphics Example

Suppose you are using your Apple Imagewriter to print custom business forms in which you want to crosshatch certain areas. The following Pascal procedure, when included in the program that generates the form, does this. It takes three previously declared integer variables passed to it from the main program:

- LEFTEDGE: the character position of the left edge of the crosshatched block
- WIDTH: the width, in ninths of an inch, of the block
- HEIGHT: the height, in ninths of an inch, of the block

This procedure assumes that the printer has been opened with a REWRITE procedure and assigned the text file identifier PRINTER.

```
PROCEDURE HATCH;
VAR N, M : INTEGER;
BEGIN
  {Set left margin}
  WRITE (PRINTER, CHR(27), 'L', LEFTEDGE:3);
  {Set character and line pitch for 72 per inch}
  WRITE (PRINTER, CHR(27), 'n', CHR(27), 'T16');
  FOR N := 1 TO HEIGHT DO
    BEGIN
    {Set Graphics Mode and width}
    WRITE (PRINTER, CHR(27), 'G', (WIDTH * 8):4);
      FOR M := 1 TO WIDTH DO
      BEGIN
      {8 bytes to produce diamond pattern}
      WRITE (PRINTER, CHR(24), CHR(36), CHR(66), CHR(129));
      WRITE (PRINTER, CHR(129), CHR(66), CHR(36), CHR(24))
      END;
    {Type each line when complete}
    WRITELN (PRINTER)
    END;
  {Restore previous margin and (pica) character and line pitch}
  WRITE (PRINTER, CHR(27), 'L000', CHR(27), 'N', CHR(27), 'A')
END;
```

You can modify the last line to suit any other character and line pitch in use outside the procedure.

Line-Oriented Graphics

You can send control codes to your Apple Imagewriter that cause it to repeat a single vertical dot pattern up to 9999 times horizontally. The result is a set of horizontal lines whose thickness and spacing (within the 1/10-inch height of the type head) are determined by a binary number. The control code must use the following prefix:

Code	Decimal	Hex	Effect
ESCAPE V nnnn c	27 86 dddd d	$1B $56 hhhh h	Types nnnn repetitions of the dot column specified by c

The character *c* is the ASCII equivalent of an eight-bit binary number specifying where dots appear in the column. Bit 0 is at the top of the column and bit 7 is at the bottom, with a 1 wherever a dot is to be printed.

This control code is useful for generating the horizontal rules used in tables and forms. The length of the rule is controlled precisely by the number nnnn of horizontal dots. The number nnnn must always have four digits; however, you can replace leading zeros with spaces. For example, to produce three hairline rules, use the character *I*, because its digital ASCII representation is 01001001.

Here are some handy values for the specifying character c:

One hairline rule:	@
Two hairline rules:	H
Three hairline rules:	I
One heavy rule:	0
Two heavy rules:	f
One extra-heavy rule:	8

Exact Dot Placement

For a table of the number of dots per inch for each character pitch, see Chapter 3, Controlling Your Printer.

For the greatest flexibility and accuracy in creating graphics with your Apple Imagewriter, use the following dot placement control code:

Code	Decimal	Hex	Effect
ESCAPE F nnnn	27 70 dddd	$1B $46 hhhh	Places succeeding printing nnnn dot positions from left margin

The number nnnn consists of four ASCII numerals, but you can replace leading zeros with spaces. The resulting placement depends on the character pitch you have in force at the time you send this control code.

By the Way: Dot positions are counted from the left margin as set by the ESCAPE L control code.

Follow each ESCAPE F control code with at least one printing control code. This may consist of an ordinary character (in which case that character is printed at the location specified), a dot column control code such as ESCAPE G or ESCAPE V, or another ESCAPE F control code. (See Line-Oriented Graphics to learn more about ESCAPE V and Column-Oriented Graphics to learn more about ESCAPE G.)

By the Way: In order for multiple ESCAPE F control codes to be executed correctly, send them to the printer in ascending numerical order (from left to right).

Creating a Format File

The printer's memory is lost every time the power is turned off. You can retain control codes for later use by setting up a format file. A format file contains control codes—outside of the memory—that prepare the printer for a specific job. You can send a format file to the Apple Imagewriter by itself, prior to running a job, or incorporate it in another text file to instruct the printer on how to format a particular section.

Many format files are quite short (only specifying character pitch, line feed pitch, and left margin setting, for example). Others that control the more sophisticated functions of the Apple Imagewriter—form tabulating commands, custom character specifications, and dot-by-dot graphics—may be very long.

Here is an example of a format file to set the character pitch at pica, the type head direction at bidirectional, the line feed pitch at six lines per inch, line feeding at forward, horizontal tab marks every five spaces (5-50), the left margin at the 11th character position, and the TOF at the current position:

ESC N ESC< ESC A ESC f ESC (005,010,015,020,025,030,035,040,045,050
ESC L 010 ESC v

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Troubleshooting

After you've checked out and installed your Apple Imagewriter, what happens if it doesn't run? You may have one of these common problems.

- **SELECT lamp lights, but Imagewriter still doesn't print?** Try Imagewriter built-in test. If built-in test is OK, check settings of Imagewriter switches SW1 and SW2 and also check that interface cable connectors are securely seated.
- **Is the cover open?** The Imagewriter has an interlock switch that prevents it from running unless the carrier cover is completely closed and latched. If the Imagewriter stops printing because the cover is open, you can restart it by replacing the cover and pressing the SELECT button.
- **Are you out of paper?** When there is less than one inch of paper left, the paper error detector underneath the platen halts the printer and turns on the PAPER ERROR light. If you want to print one or two more lines anyway, you can override this switch by pressing the SELECT button. But if you are using pin-feed paper, bear in mind that by this time it will have stopped feeding properly.



Warning
Do not print without paper under the type head. You'll damage both the platen and the printing wires.

- **Is the fuse blown?** It's easy to overlook the small cartridge fuse mounted next to the power connector on the back of the printer. If the printer won't work and the power light does not come on, unplug the power cord and remove the fuse by unscrewing the plastic cap in a counterclockwise direction. Look to see if the thin metal wire inside the fuse is broken or not. If it is, replace it with a 2-ampere type 3AG fuse, obtainable at most electronic supply or automobile part stores. If the fuse blows again, consult your Apple dealer.

- **Is an interface connection loose?** Sometimes the hookup between the printer and the Apple computer works loose. If you suspect this problem, first turn off the power and then unplug and reconnect the interface cable to the Imagewriter interface connector and to the Port 1 interface connector on the Apple IIc. Make sure that the interface cable is not damaged or pinched.
- **Are Imagewriter DIP Switches SW1 and SW2 set correctly?** Check the settings. See Chapter 2, "Setting Up Your Imagewriter," in Part I of this manual.
- **Is your system incorrectly configured?** If you are running a pre-packaged program, it may be changing the Port 1 default setting of your Apple IIc. Try running the Imagewriter built-in test and then the short printing program. See Chapter 3, "Starting to Print," in Part I of this manual. If these run OK, you may have to reconfigure your Apple IIc to run the given program. See the *Apple IIc System Utilities Manual* for information on configuring Port 1 of your Apple IIc.
- **Is the program at fault?** Sometimes software problems seem the same as hardware problems. The printer may fail to produce clean copy not because there is something wrong with its mechanism, but because the commands it receives from the computer are confusing. A quick way to check this is to run the Imagewriter built-in test. This test exercises most of the mechanical functions of the printer, as well as its internal microprocessor. If the test runs properly, you can be fairly certain that any format problems—garbled or missing text, overprinted lines—lie in the program, or possibly in the interface. Try a program that you know works, to check out the system as a whole.
- **Pin-feed paper holes torn?** Check position of the paper release lever. It should be in the pin-feed (rear) position  .
- **Is the Imagewriter overprinting?** The line length could be too long. See Buffer Overflow Action in Chapter 4, "Advanced Control Codes," of Part II. Check that Imagewriter DIP Switch SW1-8 is OPEN (no line feed after carriage return). Check that there isn't too much friction on the paper; be sure that paper release lever is in the pin-feed (rear) position when using pin-feed paper. Also, be sure that paper is free to flow out of box or container in which it is stored.
- **Is the Imagewriter printing garbled data?** Check baud setting of Imagewriter DIP Switch SW2, positions 1 and 2. They should both be set to CLOSED for 9600 baud.

- **Prints OK for a while, then prints erroneous text?** Check that protocol switch, SW2-3, is OPEN.
- **Not all dots print, or poor impression on paper?** Check ribbon and check paper thickness lever.

Command Summary

This appendix is a complete collection of all Apple Imagewriter control codes and DIP switch settings.

Printer Standard Instructions

The following are the standard instructions, or default settings, for various functions of the Apple Imagewriter:

Function	Standard Instructions
Character pitch	Elite
Proportional character spacing	1 dot width
Underlining	No underlining
Boldface printing	No boldface
Headline type	No headlines
Direction of type head motion	Bidirectional
Line feed pitch	6 lines per inch
Optional line feed function	Disabled
Line feed direction	Forward
Left margin	Character position 0
Horizontal tabs	Cleared
Vertical tabs	B tab every 6 lines

DIP Switch Settings

The standard setting for each switch is in all capitals.

For setting of switches 1-1 through 1-3 for other national (alternate) character sets, see "FYI: Imagewriter DIP Switch Settings" in Chapter 2 of Part I.

Switch	Setting	Effect	Equivalent Code
1-1	OPEN	Selects American characters	See Alternate Characters in Chapter 3 in Part II.
1-2	OPEN		
1-3	OPEN		
1-4	Closed	Page length 72 lines	
1-4	OPEN	Page length 66 lines	ESCAPE D CONTROL-@__
1-5	CLOSED	Ignores eighth data bit	ESCAPE Z CONTROL-@__
1-5	Open	Recognizes eighth data bit	(__= space character)

Switch	Setting	Effect	Equivalent Code
1-6 1-7	CLOSED OPEN	Selects Elite (12 cpi)	See Character Pitch in Chapter 3 in Part II
1-8	Closed	Adds LF after every CR	ESCAPE D ¦@¦ CONTROL-@
1-8	OPEN	No LF after CR	ESCAPE Z ¦@¦ CONTROL-@
2-1 2-2	CLOSED CLOSED	Selects 9600 Baud	See Baud Setting in Chapter 3 in Part II
2-3 2-3	Closed OPEN	XON/XOFF (Not used on IIc) Data Terminal Ready protocol	

General Control Codes

Code	Decimal	Hex	Effect
ESCAPE n	27 110	$1B $6E	Extended (9 characters per inch)
ESCAPE N	27 78	$1B $4E	Pica (10 characters per inch)
ESCAPE E	27 69	$1B $45	Elite (12 characters per inch)
ESCAPE p	27 112	$1B $70	Pica proportional
ESCAPE P	27 80	$1B $50	Elite proportional
ESCAPE e	27 101	$1B $65	Semicondensed (13.4 characters per inch)
ESCAPE q	27 113	$1B $71	Condensed (15 characters per inch)
ESCAPE Q	27 81	$1B $51	Ultracondensed (17 characters per inch)
ESCAPE _ n	27 d	$1B $h	Sets n dots between proportional characters (n = 1 to 6)
ESCAPE s _ n	27 115 d	$1B $73 $h	Sets spacing between all characters in proportional mode to n dots (n = 0 to 9)
ESCAPE R nnn c	27 82 ddd d	$1B $52 hhh h	Prints nnn repetitions of character c
CONTROL-H c	8 d	$08 h	Backspaces one character and prints the character c
ESCAPE X	27 88	$1B $58	Starts underlining text
ESCAPE Y	27 89	$1B $59	Stops underlining text
ESCAPE !	27 33	$1B $21	Starts boldface printing

Code	Decimal	Hex	Effect
ESCAPE "	27 34	$1B $22	Ends boldface printing
CONTROL-N	14	$0E	Begins headline mode
CONTROL-O	15	$0F	Ends headline mode
ESCAPE >	27 62	$1B $3E	Left-to-right printing only
ESCAPE <	27 60	$1B $3C	Bidirectional printing
ESCAPE A	27 65	$1B $41	6 lines per inch
ESCAPE B	27 66	$1B $42	8 lines per inch
ESCAPE I 1	27 108 49	$1B $6C $31	Enables optional line feed function
ESCAPE I 0	27 108 48	$1B $6C $30	Disables optional line feed function
ESCAPE T nn	27 84 dd	$1B $54 hh	Distance between lines to be nn/144 inch (nn = 01 to 99)
ESCAPE f	27 102	$1B $66	Forward (normal) line feeding
ESCAPE r	27 114	$1B $72	Reverse line feeding
CONTROL-_ n	31 d	$1F h	Feeds n lines of blank paper (n=1,2,3,4,5,6,7,8,9,:,;,<,=,>,?)
ESCAPE L nnn	27 76 ddd	$1B $4C hhh	Sets left margin to position nnn
CONTROL-L	12	$0C	Feeds paper to next top of form
ESCAPE v	27 118	$1B $76	Sets TOF to current position
ESCAPE O	27 79	$1B $4F	Paper error detector off
ESCAPE o	27 111	$1B $6F	Paper error detector on
ESCAPE Z @CONTROL-@	27 90 64 0	$1B $5A $40 $0	End-of-line at CR only
ESCAPE D @CONTROL-@	27 68 64 0	$1B $44 $40 $0	End-of-line at CR, VT, FF, HT, CONTROL-_
CONTROL-X	24	$18	Cancels all unprinted text
ESCAPE Z _CONTROL-@	27 90 32 0	$1B $5A $20 $0	No line feed at buffer overflow (_ = space character)
ESCAPE D _CONTROL-@	27 68 32 0	$1B $44 $20 $0	Line feed added at buffer overflow (_ = space character)
ESCAPE D CONTROL-@_	27 68 0 32	$1B $44 $00 $20	Ignores eighth bit of data byte (_=space character)
ESCAPE Z CONTROL-@_	27 90 0 32	$1B $5A $00 $20	Recognizes eighth bit of data byte (_=space character)
ESCAPE c	27 99	$1B $63	Restores standard instructions (Software Reset)

Tabbing Control Codes

Code	Decimal	Hex	Effect
ESCAPE (a,b, ...	27 40 d1 44 d2 44 ... 46	$1B $28 h1 $2C h2 $2C ... $2E	Sets horizontal tab line (a,b,etc. = three-digit numerals)
ESCAPE u	27 117	$1B $75	Sets selected tab
CONTROL-I	9	$09	Moves type head to next tab
ESCAPE)a,b, ...	27 41 d1 44 d2 44 ... 46	$1B $29 h1 $2C h2 $2C ... $2E	Clears selected tabs (a,b,etc. = three-digit numerals)
ESCAPE 0	27 48	$1B $30	Clears all tabs
CONTROL-] A@	29 65 64	$1D $41 $40	Sets starting top of form (TOF)
C@	67 64	$43 $40	Sets bottom of form (BOF)
A@ CONTROL-^	65 64 30	$41 $40 $1E	Sets TOF of next form
CONTROL-_ B	31 66	$1F $42	Drops to next tab B
CONTROL-_ C	31 67	$1F $43	Drops to next tab C
CONTROL-_ D	31 68	$1F $44	Drops to next tab D
CONTROL-_ E	31 69	$1F $45	Drops to next tab E
CONTROL-_ F	31 70	$1F $46	Drops to next tab F
CONTROL-_ A	31 65	$1F $41	Drops to next BOF or TOF
CONTROL-L	12	$0C	Drops to next TOF
GS 0	29 48	$1D $30	Sets vertical tabbing to power-on status, and sets TOF to current paper position

Custom Character Control Codes

Code	Decimal	Hex	Effect
ESCAPE -	27 45	$1B $2D	Maximum width will be 8 dots
ESCAPE +	27 43	$1B $2B	Maximum width will be 16 dots
ESCAPE I	27 73	$1B $49	Starts loading new character(s)
CONTROL-D	4	$04	Ends new character(s) loading
A.....P	65...80	$41...$50	Width code when using top 8 wires (A = 1 ... P = 16)
a.....p	97..112	$61...$70	Width code when using bottom 8 wires (a = 1 ... p = 16)
ESCAPE '	27 39	$1B $27	Switches to custom character font
ESCAPE *	27 42	$1B $2A	Switches to custom character font (high ASCII values)
ESCAPE $	27 36	$1B $24	Switches back to normal font

Graphics Control Codes

Code	Decimal	Hex	Effect
ESCAPE G nnnn	27 71 dddd	$1B $47 hhhh	Prints graphics columns corresponding to the following nnnn data bytes
ESCAPE S nnnn	27 83 dddd	$1B $53 hhhh	Same as ESCAPE G
ESCAPE g nnn	27 103 ddd	$1B $67 hhh	Prints line corresponding to the following nnn x 8 data bytes
ESCAPE V nnnn c	27 86 dddd d	$1B $56 hhhh h	Prints nnnn repetitions of the dot column specified by c
ESCAPE F nnnn	27 70 dddd	$1B $46 hhhh	Places succeeding printing nnnn dot positions from left margin

ASCII, Binary, and Hexadecimal Codes

There are 256 possible eight-bit binary numbers, from 00000000 to 11111111. Of these, the first 128 (from 00000000 to 01111111) have been assigned to characters and commands used in data processing and communication. Their standard assignment forms the ASCII character set. (ASCII stands for the American Standard Code for Information Interchange.)

The remaining 128, which differ from the first 128 only because their most significant binary digit (first digit) is 1 instead of 0, are not officially assigned. Nevertheless, they are often called high ASCII characters.

The following chart lists the 128 standard ASCII character assignments. For each character it gives the binary, decimal, and hexadecimal equivalents for both standard and high versions. Note that the first 27 codes are control characters set by pressing the CONTROL key simultaneously with the desired character key.

	Low ASCII				High ASCII		
ASCII	Dec	Hex	76543210	Dec	Hex	76543210
CONTROL-@ NUL	0	00	00000000	128	80	10000000
CONTROL-A SOH	1	01	00000001	129	81	10000001
CONTROL-B STX	2	02	00000010	130	82	10000010
CONTROL-C ETX	3	03	00000011	131	83	10000011
CONTROL-D EOT	4	04	00000100	132	84	10000100
CONTROL-E ENQ	5	05	00000101	133	85	10000101
CONTROL-F ACK	6	06	00000110	134	86	10000110
CONTROL-G BEL	7	07	00000111	135	87	10000111
CONTROL-H BS	8	08	00001000	136	88	10001000
CONTROL-I HT	9	09	00001001	137	89	10001001
CONTROL-J LF	10	0A	00001010	138	8A	10001010
CONTROL-K VT	11	0B	00001011	139	8B	10001011
CONTROL-L FF	12	0C	00001100	140	8C	10001100
CONTROL-M CR	13	0D	00001101	141	8D	10001101
CONTROL-N SO	14	0E	00001110	142	8E	10001110
CONTROL-O SI	15	0F	00001111	143	8F	10001111
CONTROL-P DLE	16	10	00010000	144	90	10010000
CONTROL-Q DC1	17	11	00010001	145	91	10010001

ASCII		Low ASCII Dec	Hex	76543210	High ASCII Dec	Hex	76543210
CONTROL-R	DC2	18	12	00010010	146	92	10010010
CONTROL-S	DC3	19	13	00010011	147	93	10010011
CONTROL-T	DC4	20	14	00010100	148	94	10010100
CONTROL-U	NAK	21	15	00010101	149	95	10010101
CONTROL-V	SYN	22	16	00010110	150	96	10010110
CONTROL-W	ETB	23	17	00010111	151	97	10010111
CONTROL-X	CAN	24	18	00011000	152	98	10011000
CONTROL-Y	EM	25	19	00011001	153	99	10011001
CONTROL-Z	SUB	26	1A	00011010	154	9A	10011010
	ESC	27	1B	00011011	155	9B	10011011
	FS	28	1C	00011100	156	9C	10011100
	GS	29	1D	00011101	157	9D	10011101
	RS	30	1E	00011110	158	9E	10011110
	US	31	1F	00011111	159	9F	10011111
	SP	32	20	00100000	160	A0	10100000
	!	33	21	00100001	161	A1	10100001
	"	34	22	00100010	162	A2	10100010
	#	35	23	00100011	163	A3	10100011
	$	36	24	00100100	164	A4	10100100
	%	37	25	00100101	165	A5	10100101
	&	38	26	00100110	166	A6	10100110
	'	39	27	00100111	167	A7	10100111
	(	40	28	00101000	168	A8	10101000
	)	41	29	00101001	169	A9	10101001
	*	42	2A	00101010	170	AA	10101010
	+	43	2B	00101011	171	AB	10101011
	,	44	2C	00101100	172	AC	10101100
	-	45	2D	00101101	173	AD	10101101
	.	46	2E	00101110	174	AE	10101110
	/	47	2F	00101111	175	AF	10101111
	0	48	30	00110000	176	B0	10110000
	1	49	31	00110001	177	B1	10110001
	2	50	32	00110010	178	B2	10110010
	3	51	33	00110011	179	B3	10110011
	4	52	34	00110100	180	B4	10110100
	5	53	35	00110101	181	B5	10110101
	6	54	36	00110110	182	B6	10110110
	7	55	37	00110111	183	B7	10110111
	8	56	38	00111000	184	B8	10111000
	9	57	39	00111001	185	B9	10111001
	:	58	3A	00111010	186	BA	10111010
	;	59	3B	00111011	187	BB	10111011
	<	60	3C	00111100	188	BC	10111100
	=	61	3D	00111101	189	BD	10111101
	>	62	3E	00111110	190	BE	10111110
	?	63	3F	00111111	191	BF	10111111
	@	64	40	01000000	192	C0	11000000
	A	65	41	01000001	193	C1	11000001
	B	66	42	01000010	194	C2	11000010
	C	67	43	01000011	195	C3	11000011
	D	68	44	01000100	196	C4	11000100
	E	69	45	01000101	197	C5	11000101
	F	70	46	01000110	198	C6	11000110
	G	71	47	01000111	199	C7	11000111
	H	72	48	01001000	200	C8	11001000
	I	73	49	01001001	201	C9	11001001

ASCII	Low ASCII Dec	Hex	76543210	High ASCII Dec	Hex	76543210
J	74	4A	01001010	202	CA	11001010
K	75	4B	01001011	203	CB	11001011
L	76	4C	01001100	204	CC	11001100
M	77	4D	01001101	205	CD	11001101
N	78	4E	01001110	206	CE	11001110
O	79	4F	01001111	207	CF	11001111
P	80	50	01010000	208	D0	11010000
Q	81	51	01010001	209	D1	11010001
R	82	52	01010010	210	D2	11010010
S	83	53	01010011	211	D3	11010011
T	84	54	01010100	212	D4	11010100
U	85	55	01010101	213	D5	11010101
V	86	56	01010110	214	D6	11010110
W	87	57	01010111	215	D7	11010111
X	88	58	01011000	216	D8	11011000
Y	89	59	01011001	217	D9	11011001
Z	90	5A	01011010	218	DA	11011010
[	91	5B	01011011	219	DB	11011011
\	92	5C	01011100	220	DC	11011100
]	93	5D	01011101	221	DD	11011101
^	94	5E	01011110	222	DE	11011110
_	95	5F	01011111	223	DF	11011110
`	96	60	01100000	224	E0	11100000
a	97	61	01100001	225	E1	11100001
b	98	62	01100010	226	E2	11100010
c	99	63	01100011	227	E3	11100011
d	100	64	01100100	228	E4	11100100
e	101	65	01100101	229	E5	11100101
f	102	66	01100110	230	E6	11100110
g	103	67	01100111	231	E7	11100111
h	104	68	01101000	232	E8	11101000
i	105	69	01101001	233	E9	11101001
j	106	6A	01101010	234	EA	11101010
k	107	6B	01101011	235	EB	11101011
l	108	6C	01101100	236	EC	11101100
m	109	6D	01101101	237	ED	11101101
n	110	6E	01101110	238	EE	11101110
o	111	6F	01101111	239	EF	11101111
p	112	70	01110000	240	F0	11110000
q	113	71	01110001	241	F1	11110001
r	114	72	01110010	242	F2	11110010
s	115	73	01110011	243	F3	11110011
t	116	74	01110100	244	F4	11110100
u	117	75	01110101	245	F5	11110101
v	118	76	01110110	246	F6	11110110
w	119	77	01110111	247	F7	11110111
x	120	78	01111000	248	F8	11111000
y	121	79	01111001	249	F9	11111001
z	122	7A	01111010	250	FA	11111010
{	123	7B	01111011	251	FB	11111011
|	124	7C	01111100	252	FC	11111100
}	125	7D	01111101	253	FD	11111101
~	126	7E	01111110	254	FE	11111110
DEL	127	7F	01111111	255	FF	11111111

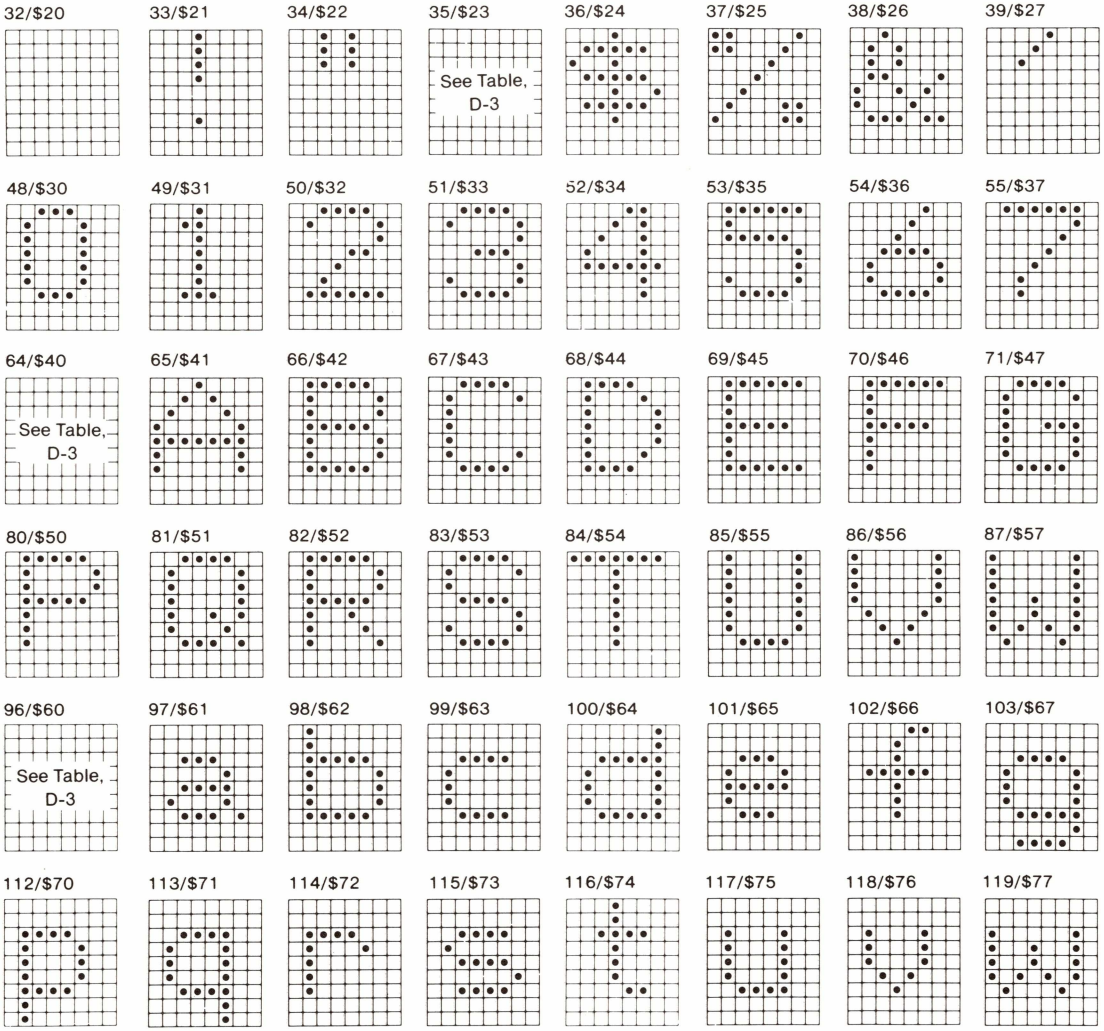
Character Specifications

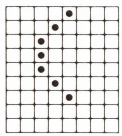
This appendix depicts the printer's stored dot-matrix patterns for all characters in both fixed-width and proportional printing modes.

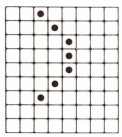
Fixed-Width Characters

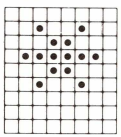
Table D-1. *Fixed-Width Characters*

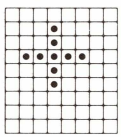
All fixed-width characters are created by eight vertical columns, each of which is nine dots tall. The right-most column never contains dots, and the bottom two dots in each column are used only by lowercase characters with descenders, commas, and semicolons. The decimal and hexadecimal codes for each character appear at its upper left.

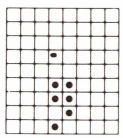


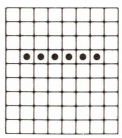
40/$28 

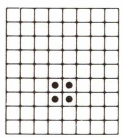
41/$29 

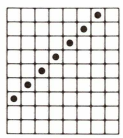
42/$2A 

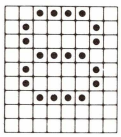
43/$2B 

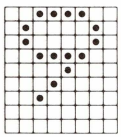
44/$2C 

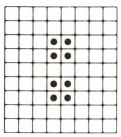
45/$2D 

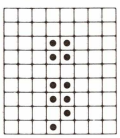
46/$2E 

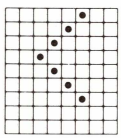
47/$2F 

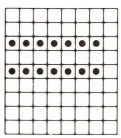
56/$38 

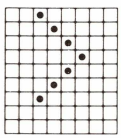
57/$39 

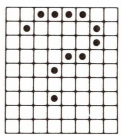
58/$3A 

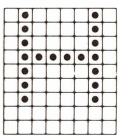
59/$3B 

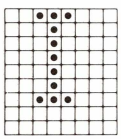
60/$3C 

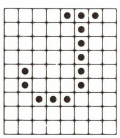
61/$3D 

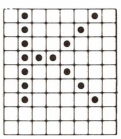
62/$3E 

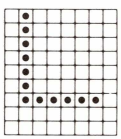
63/$3F 

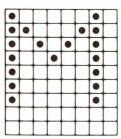
72/$48 

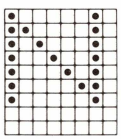
73/$49 

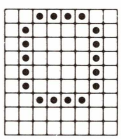
74/$4A 

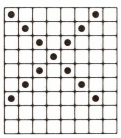
75/$4B 

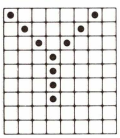
76/$4C 

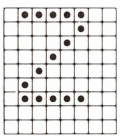
77/$4D 

78/$4E 

79/$4F 

88/$58 

89/$59 

90/$5A 

91/$5B

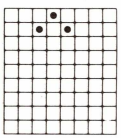
See Table, D-3

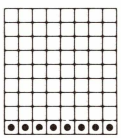
92/$5C

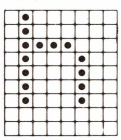
See Table, D-4

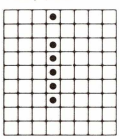
93/$5D

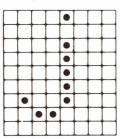
See Table, D-3

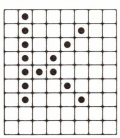
94/$5E 

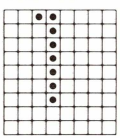
95/$5F 

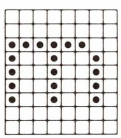
104/$68 

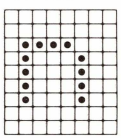
105/$69 

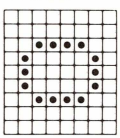
106/$6A 

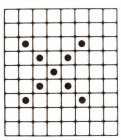
107/$6B 

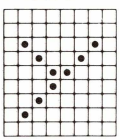
108/$6C 

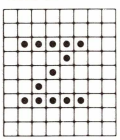
109/$6D 

110/$6E 

111/$6F 

120/$78 

121/$79 

122/$7A 

123/$7B

See Table, D-3

124/$7C

See Table, D-3

125/$7D

See Table, D-3

126/$7E

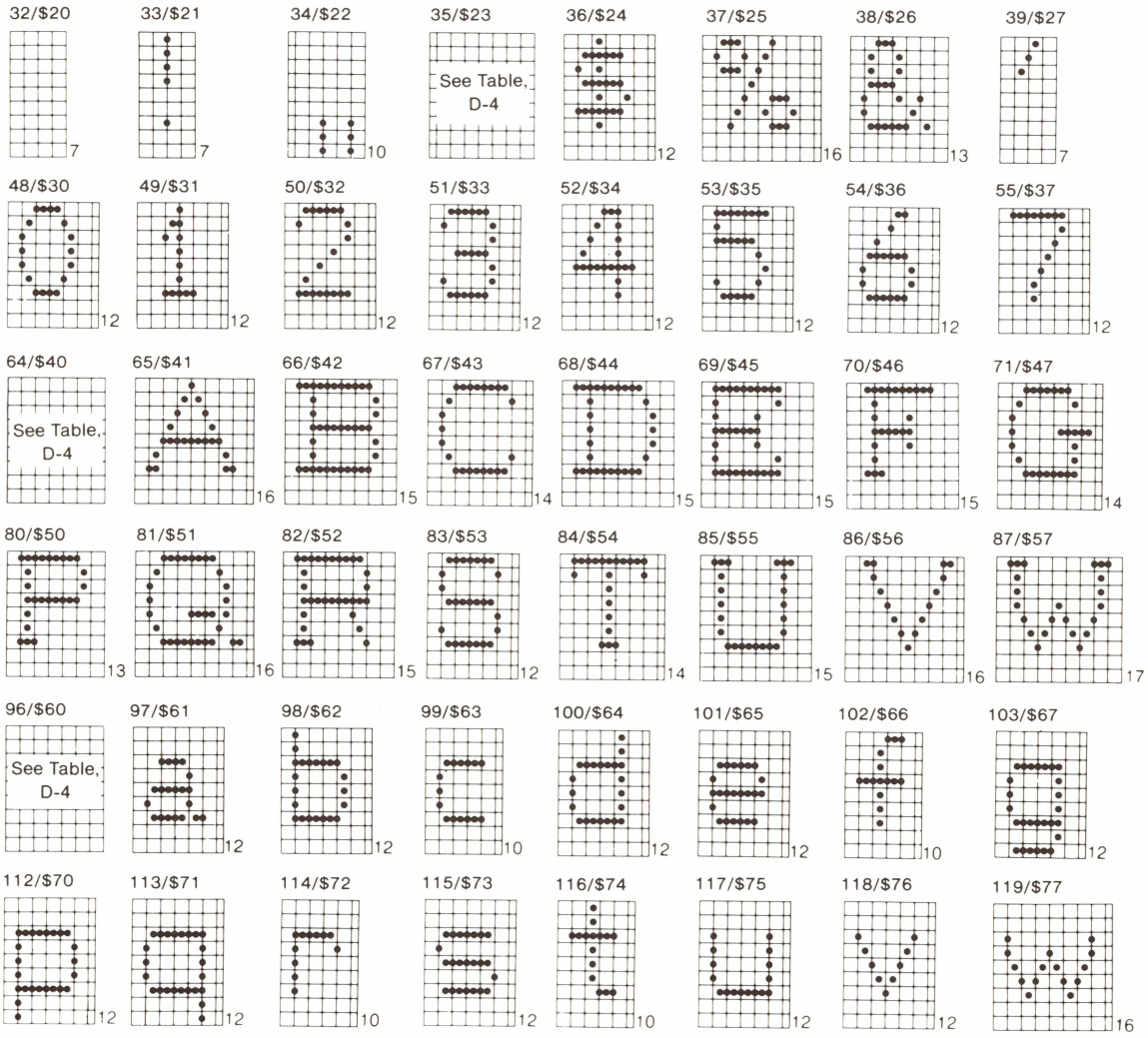
See Table, D-3

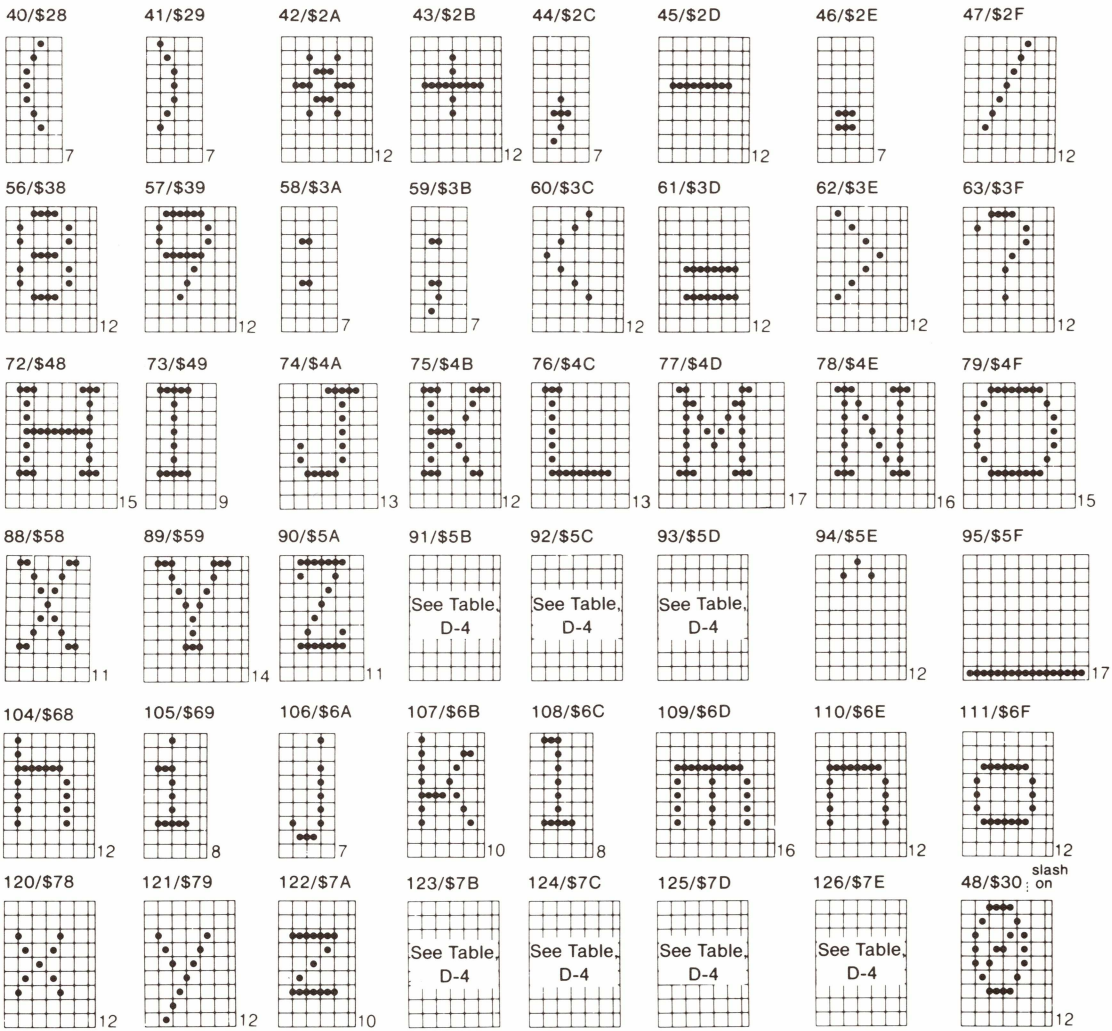
48/$30 slash on

Proportional American Characters

Table D-2. *Proportional American Characters*

Widths of proportional characters vary. In the following chart, the width of each character appears at its lower right. The decimal and hexadecimal code for each character appear at its upper left.

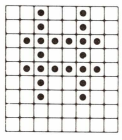
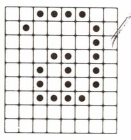
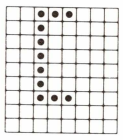
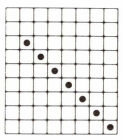
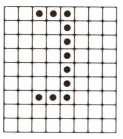
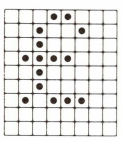
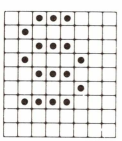
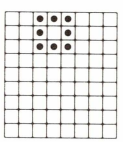
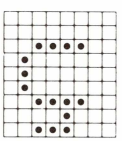
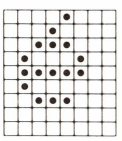
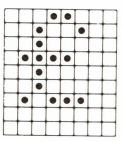
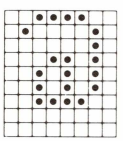
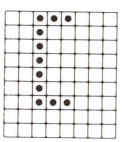
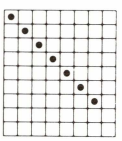
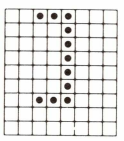
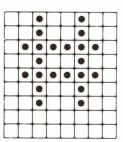
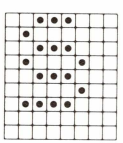
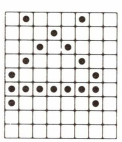
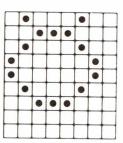
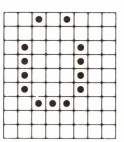
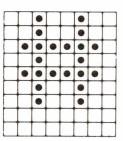
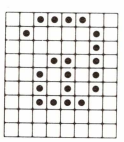
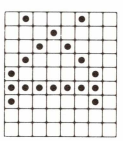
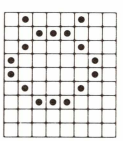
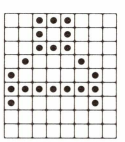
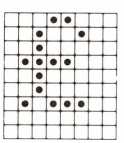
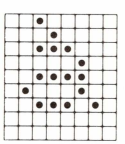
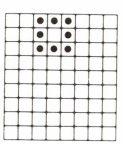
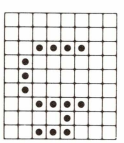
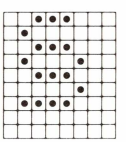
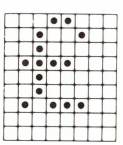
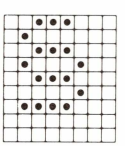
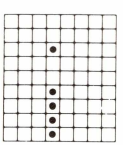
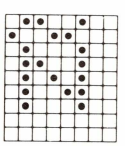
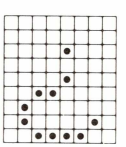


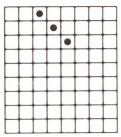
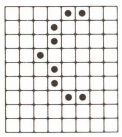
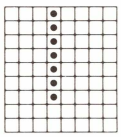
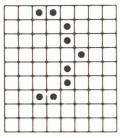
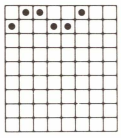
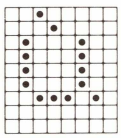
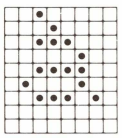
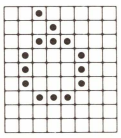
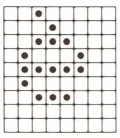
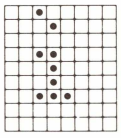
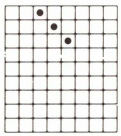
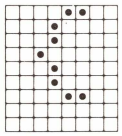
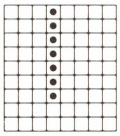
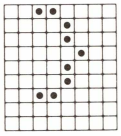
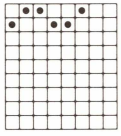
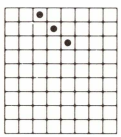
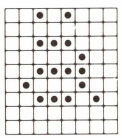
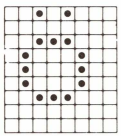
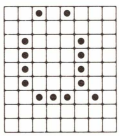
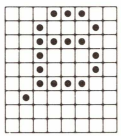
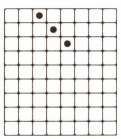
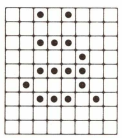
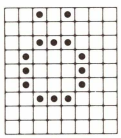
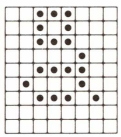
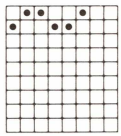
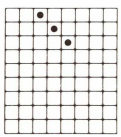
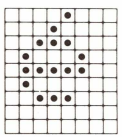
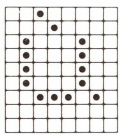
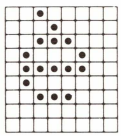
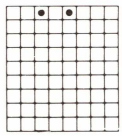
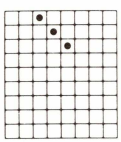
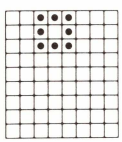
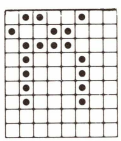
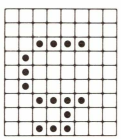
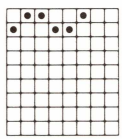

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See Table D-4
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109/$6D
16
110/$6E
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111/$6F
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120/$78
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121/$79
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122/$7A
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123/$7B
See Table D-4
124/$7C
See Table D-4
125/$7D
See Table D-4
126/$7E
See Table D-4
48/$30
slash on
12

Fixed-Width Alternate Language Characters

Table D-3. *Fixed-Width Alternate Language Characters*

All fixed-width alternate language characters are created by eight vertical columns of dots, each of which is nine dots high. The rightmost column never contains dots. The decimal and hexadecimal code for each character appears in the table heading.

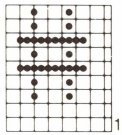
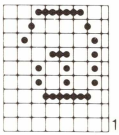
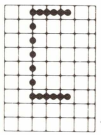
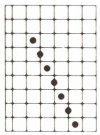
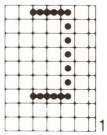
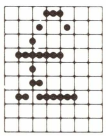
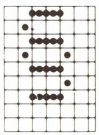
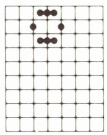
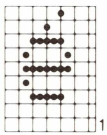
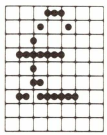
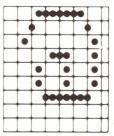
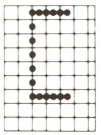
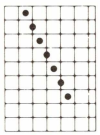
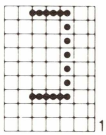
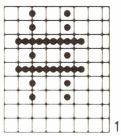
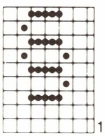
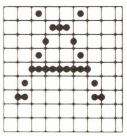
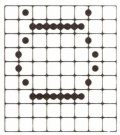
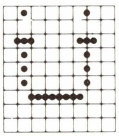
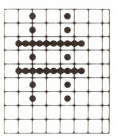
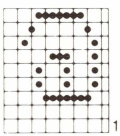
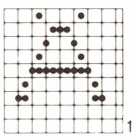
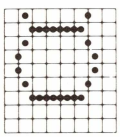
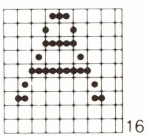
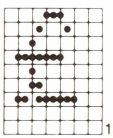
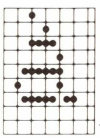
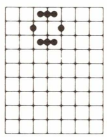
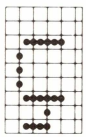
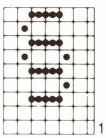
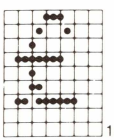
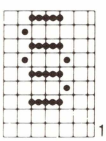
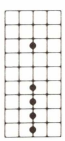
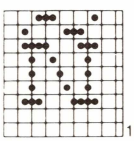
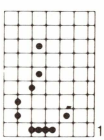
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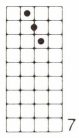
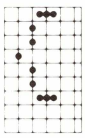
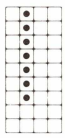
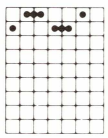
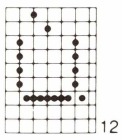
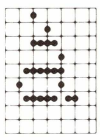
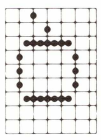
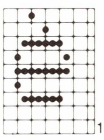
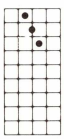
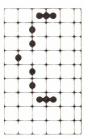
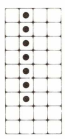
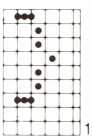
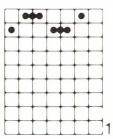
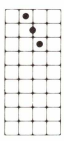
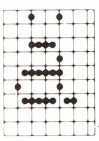
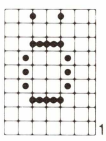
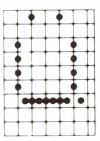
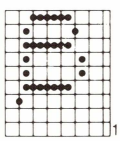
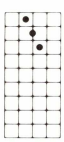
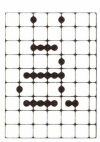
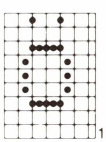
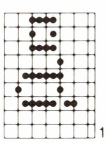
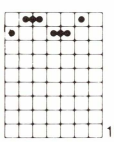
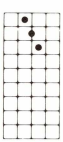
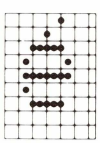
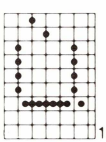
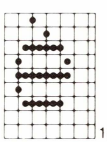
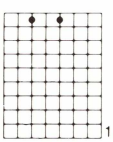
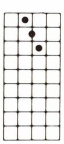
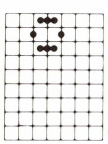
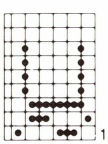
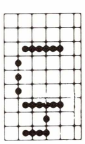
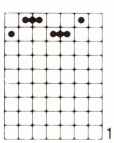
96/$60	123/$7B	124/$7C	125/$7D	126/$7E
				
				
				
				
				
				
				

Proportional Alternate Language Characters

Table D-4. *Proportional Alternate Language Characters*

Widths of proportional alternate language characters vary. In the following chart, the width of the character appears at its lower right. The decimal and hexadecimal code for each character appears in the table heading.

ASCII CODE (Dec. Hex.) / LANGUAGE	35/$23	64/$40	91/$5B	92/$5C	93/$5D
ENGLISH (USA)	 14	 14	 12	 12	 12
ITALIAN	 13	 12	 13	 10	 12
ENGLISH (UK)	 13	 14	 12	 12	 12
GERMAN	 14	 12	 16	 15	 15
SWEDISH	 14	 14	 16	 15	 16
FRENCH	 13	 12	 13	 10	 12
SPANISH	 13	 12	 7	 16	 12

96/$60	123/$7B	124/$7C	125/$7D	126/$7E
 7	 10	 7	 10	 13
 12	 12	 12	 12	 8
 7	 10	 7	 10	 13
 7	 12	 12	 12	 14
 7	 12	 12	 12	 13
 7	 12	 12	 12	 13
 7	 13	 12	 10	 13

Printer Specifications

Print Method:	Dot matrix, logic seek (line by line)
Printing Speed:	At 10 characters per inch: 120 characters per second 72 lines per minute
Character Format:	Standard characters: Up to 7 dots wide by 8 dots high Custom (down-loaded) characters: Up to 16 dots wide by 8 dots high
Standard Characters:	96 ASCII (alphanumeric and symbols) 25 European language characters
Vertical Dot Spacing:	1/72 of an inch
Line Length:	8 inches maximum

Horizontal Pitches:

Characters per Inch	**Characters per Line**	**Dots per Inch (Approx.)**
17	136	136
15	120	120
13.4	107	107
12	96	96
10	80	80
9	72	72
8.5	68	136
7.5	60	120
6.7	53.5	107
6	48	96
5	40	80
4.5	36	72
variable	variable	160
variable	variable	144

Paper Feed Direction:	Forward and reverse
Line Spacing:	1/144 to 99/144 of an inch, selectable in increments of 1/144 of an inch
Line Feed Method:	Stepper motor drive
Line Feed Speed:	Maximum 10 per second at 6 lines per inch

Paper Width:	3 to 10 inches
Paper Thickness:	0.05 - 0.28 millimeter (0.002 - 0.011 inch) Original + 3 copies maximum
Paper Feed Method:	Selectable, friction or sprocket/pin feed
Paper Types:	Single sheets Fanfold sprocketed paper (hole centers 4.0 - 9.5 inches)
Paper Entry:	Top rear of printer
Ribbon:	Cassette containing inked fabric ribbon (black recommended), 13 millimeters wide by 13,000 millimeters long, automatically reversing
Power Options:	115 volts AC ± 10%, 60 hertz 100 volts AC ± 10%, 50/60 hertz 220 volts AC ± 10%, 50 hertz 240 volts AC ± 10%, 50 hertz
Power Consumption:	Operating: 180 watts maximum Standby: 16 watts maximum
Data Interface:	8-bit serial (see Appendix F)
Weight:	8.5 kilograms (18.75 pounds)

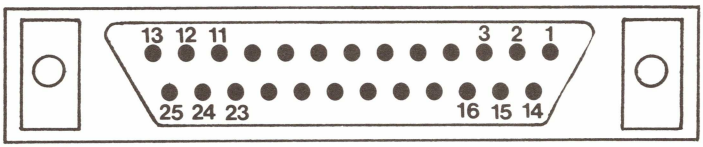
Dimensions:	**Width**	**Depth**	**Height**
	398	285	125 millimeters
	15.7	11.3	5.3 inches

Ambient Temperature:	
Operating	5 to 40 degrees Celsius (41 to 104 degrees Fahrenheit)
Storage	−25 to +60 degrees Celsius (−13 to +140 degrees Fahrenheit)
Maximum Humidity:	
Operating	85% relative humidity, noncondensing
Storage	90% relative humidity, noncondensing

Interface Specifications

Data Input Form:	7-bit or 8-bit serial: 1 start bit, data bits (7 or 8), and 1 stop bit (no parity bit)
Data Input Codes:	Characters: ASCII, 8- or 7-bit Graphics: 8-bit binary
Transmission Speed:	300, 1200, 2400, or 9600 baud
Input Buffer Size:	1K bytes
Printer Connector:	DB-25 male, or equivalent
Mating Connector:	DB-25S female, or equivalent

Figure F-1. *RS232C Connector Pin Assignment*



Pin No	Symbol	Description	Direction
1	FG	Frame Ground	
2	SD	Send Data	Output
3	RD	Receive Data	Input
4	RTS	Request to Send	Output
7	SG	Signal Ground	
14	FAULT	$\overline{\text{Fault}}$	Output
20	DTR	Data Terminal Ready	Output

Signal Descriptions

Frame Ground: Grounding line for circuit protection.

Send Data: Serial data transmission line to the computer from the printer. False when no data are being sent; true when data are being sent.

Receive Data: Serial data transmission line to the printer from the computer. False when no data are being sent; true when data are being sent.

Request to Send: Output signal from the printer; true when the printer is turned on.

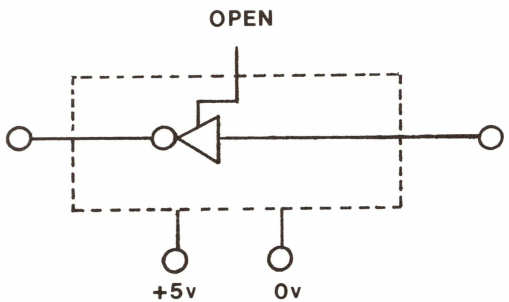
$\overline{\text{Fault}}$: Output signal from the printer. False when the printer is deselected; true when selected.

Data Terminal Ready: Output signal from the printer. True when the printer is on and able to receive data; false when unable to receive data.

Input Circuit Configuration

RD signal: Maximum +15V, minimum +5V.

Figure F-2. *Circuit: SN 75 189A, or equivalent*



Output Circuit Configuration

SD, RTS, DTR, and FAULT signals: Nominal +7V

Figure F-3. *Circuit: SN 75 188, or equivalent*

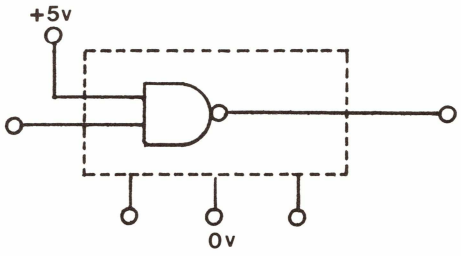
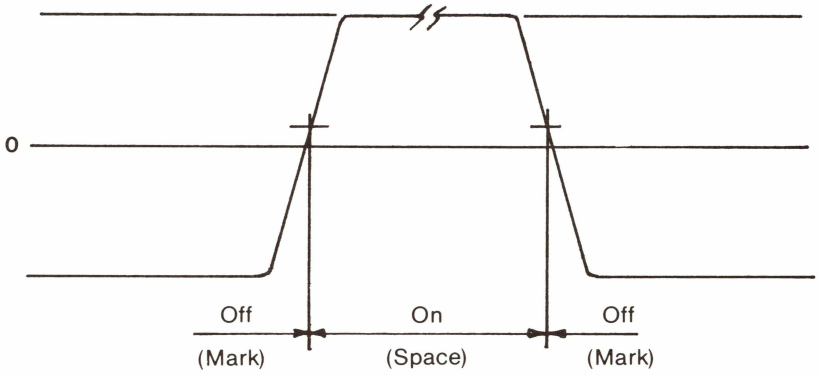


Figure F-4. *Threshold Voltage Level*



Protocol

The printer is capable of two types of data protocol: XON/XOFF or Data Transfer Ready (DTR). The DTR protocol uses the DTR signal to indicate the printer state. The XON/XOFF protocol uses the serial ASCII codes for XON and XOFF, but is not applicable to the Apple IIc.

Data Transfer Ready Protocol

Whenever the capacity of the input buffer becomes less than 30 characters, the printer sends a busy signal by setting the DTR line false. The computer must stop transmission within the next 27 characters; if it does not, the printer will ignore the excess data. The DTR line is also set false when the printer is deselected, and when it receives a DC3 character. The DTR line is true whenever there is room for at least 100 characters in the input buffer, when the printer is turned on, selected, and has received a DC1 character.

XON/XOFF Protocol

Whenever the capacity of the input buffer becomes less than 266 characters, the printer sends an XOFF character. The computer must stop transmission when it receives the XOFF character; if it does not, the printer will ignore the excess data. An XOFF character is also sent when the printer is deselected, and when it receives a DC3 character (unless an XOFF character has been sent because the buffer is full). The printer sends an XON character whenever there is room for at least 337 characters in the input buffer, when the printer is turned on, and when the printer is selected (only if an XOFF character has been sent). The XON/XOFF protocol is not used by the Apple IIc.

Glossary

Applesoft BASIC: A programming language that can be used with Apple computers. BASIC stands for Beginners All-Purpose Symbolic Instruction Code.

ASCII: Acronym for American Standard Code for Information Interchange, the information code that is sent to the Apple Imagewriter. It assigns a unique binary number to each character. See Appendix C.

binary: The number system used by most digital computers. Every binary number consists of a string of zeros and ones; the farthest right (least significant) digit has a value of 1, the next a value of 2, then 4, 8, 16, and so on.

bit: A single binary digit, consisting of either a zero or a one.

boot disk: A disk containing the programs and data that the Apple Computer needs to get started when power is turned on.

buffer: A memory area that holds information until it can be processed. The Apple Imagewriter has an input buffer, which stores excess incoming text until the mechanism has time to print it.

byte: A binary number of fixed length. In the Apple Imagewriter, bytes are eight bits long. Every character processed by the printer can be expressed as one byte, using the ASCII code.

character: Any letter, number, punctuation mark, or control code that can be acted upon by the printer. There are 256 possible characters, corresponding to the range of eight-bit binary numbers.

character pitch: The number of characters per inch printed along a horizontal line.

character set: The entire set of characters that can be printed by a device such as the Apple Imagewriter.

clear: To erase information or commands from memory, as when the Apple Imagewriter clears its horizontal tab stops.

command structure: The nature and interrelations of all the possible instructions that can be sent to a device such as a computer or printer. The Apple Imagewriter's command structure is summarized in Appendix B.

compile: To convert a program (source file) written by a human being into a file of commands that the computer can follow to make the program work.

control character: A nonprinting ASCII character that allows you to perform special functions with the Apple Imagewriter.

control code: One or more characters whose function is to change the way the printer acts (as opposed to text, which is simply printed).

control sequence: An ESCAPE character followed by a sequence of characters whose function is to change the nature of the characters that follow.

device: A piece of equipment connected to a computer. The Apple Imagewriter is a device, along with the video monitor, disk drives, and so on.

DIP switch: A small switch that affects a printer function and can be operated manually. There are 12 DIP switches located inside the case of the Apple Imagewriter. DIP stands for dual in-line package.

disk drive: A device that records and reads computer disks, somewhat like a phonograph.

dot matrix: The method by which the Apple Imagewriter prints. Each character is formed by a pattern of dots, each of which is located at one of the intersections of a fixed grid.

editor: A program that helps the user create and change text files by providing commands to insert and delete text, and perform other functions.

Electronic Vertical Form Unit (EVFU): A section of memory in the Apple Imagewriter that holds vertical tab commands for an entire page.

end-of-line character: Any character that tells the printer that the preceding text constitutes a full line and may now be printed.

ESCAPE character: An ASCII character that allows you to perform special functions with the Apple Imagewriter.

escape code: A sequence of characters, beginning with ESCAPE, that constitutes a complete command to the printer.

execute: To perform the actions specified by a program command or sequence of commands.

fanfold paper: Special paper supplied for computer printers such as the Apple Imagewriter. One continuous sheet, perforated and folded like the letter Z so that it lies in a stack.

file: In a computer, any named, ordered collection of data. Apple computer files are normally stored on disks. Text files are files of text, while data files are files of data and code files are files of code (usually the programs that make it easier for you to use the computer).

font: A complete set of type in one size and style of characters.

format: The general shape and appearance of the printer's output, including page size, character width and spacing, line spacing, and other factors.

function: In a programming language, an instruction that converts data from one form to another. The CHR or CHR$ function, for example, converts an ASCII code number into its corresponding character.

graphics: Designs and pictures as opposed to written text, when referring to the capabilities of a device such as a printer.

hardware: In computer technology, the physical machinery; opposed to software, the program instructions.

hex, hexadecimal: The base-16 number system. (Ordinary decimal numbers are base-10.) Hexadecimal numerals consist of 0, the numerals 1-9, and the capital letters A-F. See Appendix C.

high ASCII characters: The set of ASCII characters with decimal equivalents from 128 to 255. Called *high* ASCII because their high bit (left most binary digit) is set to 1 (for on) rather than 0 (for off).

interface: In computer hardware, the equipment that accepts electrical signals from one part of a system and renders them into a form that can be used by another part.

interlock: In a machine such as a printer, a safety device that prevents operation under certain conditions, such as when the cover is open.

leading zero: A zero occurring at the beginning of a number, deleted by most computing programs.

line feed: An ASCII character (hex code ØA) that instructs a device such as a printer to feed one line of paper. Also refers to a vertical motion of the platen, moving the paper up one print line.

line feed pitch: The number of lines printed per vertical inch.

memory: Any part of a computer system that stores data.

microprocessor: A small circuit component (about the size of a postage stamp) that performs a complete set of basic computing functions.

operating system: The most fundamental program in a computer, which organizes the actions of the various parts of the computer and allows it to use other programs.

overflow: The condition that exists when an attempt is made to put more data into a memory than it can hold.

override: To modify or cancel a longstanding instruction with a temporary one.

Pascal: A higher-level programming language with statements that resemble English sentences. Named after the philosopher and mathematician Blaise Pascal.

pin-feed paper: Multisheet paper that has sprocket holes along both edges, for printers such as the Apple Imagewriter. Each page is separated from the next by perforations (just like paper towels). The paper is folded at the perforations to make a stack that feeds continuously into the printer.

platen: The rubber roller in a printer, which provides a backing for the printing action.

procedure: In the Pascal programming language, a set of instructions that work as a unit; equivalent to the subprogram in BASIC.

SEL, select: A command to a device such as a printer to place it into a condition to receive data.

6502 Language: The programming language actually used by the components of Apple computers; also called machine code.

software: In general, programs and program instructions; as opposed to hardware, the machinery that runs software.

sprocket: In the Apple Imagewriter, either of the toothed wheels at the back that engage pin-feed paper and pull it through the machine.

stack: In a computer, a memory that is used for temporary storage of operating data during operation of a program.

standard instruction: An instruction automatically present when no superseding instruction has been received. The Apple Imagewriter assumes a set of standard instructions every time power is turned on. These are listed in Appendix B.

TAB: An ASCII character that commands a device such as a printer to start printing at a preset location (called a tab stop). There are two such characters: horizontal tab (hex Ø9) and vertical tab (hex ØB). Corresponds to tab on a typewriter.

TOF, top of form: Usually, the very top of a page of text.

type head: In the Apple Imagewriter, the part that moves horizontally along the platen and performs the actual printing.

wires: In the Apple Imagewriter, the nine strikers in the type head, each of which prints one dot.

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Apple® Imagewriter Character Set

ASCII	Dec	Hex	ASCII	Dec	Hex	ASCII	Dec	Hex	ASCII	Dec	Hex
NUL	00	$ 0 0	SP	32	$ 20	②*	64	$ 40	⑦*	96	$ 60
SOH	01	$ 0 1	!	33	$ 21	A	65	$ 41	a	97	$ 61
STX	02	$ 0 2	"	34	$ 22	B	66	$ 42	b	98	$ 62
ETX	03	$ 0 3	⓪*	35	$ 23	C	67	$ 43	c	99	$ 63
EOT	04	$ 0 4	①*	36	$ 24	D	68	$ 44	d	100	$ 64
ENQ	05	$ 0 5	%	37	$ 25	E	69	$ 45	e	101	$ 65
ACK	06	$ 0 6	&	38	$ 26	F	70	$ 46	f	102	$ 66
BEL	07	$ 0 7	'	39	$ 27	G	71	$ 47	g	103	$ 67
BS	08	$ 0 8	(	40	$ 28	H	72	$ 48	h	104	$ 68
HT	09	$ 0 9	)	41	$ 29	I	73	$ 49	i	105	$ 69
LF	10	$ 0 A	*	42	$ 2A	J	74	$ 4A	j	106	$ 6A
VT	11	$ 0 B	+	43	$ 2B	K	75	$ 4B	k	107	$ 6B
FF	12	$ 0 C	,	44	$ 2C	L	76	$ 4C	l	108	$ 6C
CR	13	$ 0 D	-	45	$ 2D	M	77	$ 4D	m	109	$ 6D
SO	14	$ 0 E	.	46	$ 2E	N	78	$ 4E	n	110	$ 6E
SI	15	$ 0 F	/	47	$ 2F	O	79	$ 4F	o	111	$ 6F
DLE	16	$ 10	0	48	$ 30	P	80	$ 50	p	112	$ 70
DC1	17	$ 11	1	49	$ 31	Q	81	$ 51	q	113	$ 71
DC2	18	$ 12	2	50	$ 32	R	82	$ 52	r	114	$ 72
DC3	19	$ 13	3	51	$ 33	S	83	$ 53	s	115	$ 73
DC4	20	$ 14	4	52	$ 34	T	84	$ 54	t	116	$ 74
NAK	21	$ 15	5	53	$ 35	U	85	$ 55	u	117	$ 75
SYN	22	$ 16	6	54	$ 36	V	86	$ 56	v	118	$ 76
ETB	23	$ 17	7	55	$ 37	W	87	$ 57	w	119	$ 77
CAN	24	$ 18	8	56	$ 38	X	88	$ 58	x	120	$ 78
EM	25	$ 19	9	57	$ 39	Y	89	$ 59	y	121	$ 79
SUB	26	$ 1A	:	58	$ 3A	Z	90	$ 5A	z	122	$ 7A
ESC	27	$ 1B	;	59	$ 3B	③*	91	$ 5B	⑧*	123	$ 7B
FS	28	$ 1C	<	60	$ 3C	④*	92	$ 5C	⑨*	124	$ 7C
GS	29	$ 1D	=	61	$ 3D	⑤*	93	$ 5D	⑩*	125	$ 7D
RS	30	$ 1E	>	62	$ 3E	⑥*	94	$ 5E	⑪*	126	$ 7E
US	31	$ 1F	?	63	$ 3F	-	95	$ 5F	DEL	127	$ 7F

Note: The reference symbol ◯* refers to the Apple Imagewriter Extended Character Set table below for Alternate (National) Languages:

Apple Imagewriter Alternate Character Set (For National Languages)

Reference Number	0	1	2	3	4	5	6	7	8	9	10	11
Hexadecimal	$ 23	$ 24	$ 40	$ 5B	$ 5C	$ 5D	$ 5E	$ 60	$ 7B	$ 7C	$ 7D	$ 7E
American	#	$	@	[	\	]	^	`	{	|	}	~
British	£	$	@	[	\	]	^	`	{	|	}	~
German	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
French	£	$	à	Ä	Ö	§	^	`	é	ù	è	¨
Swedish	#	$	@	Ä	Ö	Å	^	`	ä	ö	å	~
Italian	£	$	§	°	ç	é	^	ù	à	ò	è	ì
Spanish	£	$	§	¡	Ñ	¿	^	`	■	ñ	ç	~

Imagewriter DIP Switch Settings

For use with the Apple IIc, the normal position of DIP switches SW1 and SW2 on the Imagewriter are as indicated in capital letters.

SW1-1	*SW1-2*	*SW1-3*	
OPEN	**OPEN**	**OPEN**	**American**
Closed	*Closed*	*Open*	*British*
Open	*Open*	*Close*	*German*
Open	*Closed*	*Closed*	*French*
Closed	*Open*	*Closed*	*Swedish*
Closed	*Open*	*Open*	*Italian*
Closed	*Closed*	*Closed*	*Spanish*
Open	*Closed*	*Open*	*American*

SW1-4	
OPEN	**Page Length: 66 lines**
Closed	*Page Length: 72 lines*

SW1-5	
CLOSED	**Ignores 8th data bit, allowing reception of high ASCII as from Applesoft BASIC**
Open	*Recognizes 8th data bit*

SW1-6	*SW1-7*	
Open	*Open*	*Pica (10 chars. per inch)*
CLOSED	**OPEN**	**Elite (12 chars. per inch)**
Open	*Closed*	*Ultracondensed (17 chars. per inch)*
Closed	*Closed*	*Elite proportional (144 dots per inch)*

SW1-8	
Closed	*Adds line feed after every carriage return*
OPEN	**No line feed after carriage return**

SW2-1	*SW2-2*	
Open	*Open*	*300 Baud*
Closed	*Open*	*1200 Baud*
Open	*Closed*	*2400 Baud*
CLOSED	**CLOSED**	**9600 Baud**

SW2-3	
OPEN	**Data terminal ready**
Closed	*XON/XOFF (not used by Apple IIc)*

SW2-4	
OPEN	**(not used)**

General Control Codes

Code	Decimal	Hex	Effect
ESCAPE n	27 110	$1B $6E	Extended (9 characters per inch)
ESCAPE N	27 78	$1B $4E	Pica (10 characters per inch)
ESCAPE E	27 69	$1B $45	Elite (12 characters per inch)
ESCAPE p	27 112	$1B $70	Pica proportional
ESCAPE P	27 80	$1B $50	Elite proportional
ESCAPE e	27 101	$1B $65	Semicondensed (13.4 characters per inch)
ESCAPE q	27 113	$1B $71	Condensed (15 characters per inch)
ESCAPE Q	27 81	$1B $51	Ultracondensed (17 characters per inch)
ESCAPE _ n	27 d	$1B $h	Sets n dots between proportional characters (n = 1 to 6)
ESCAPE s _ n	27 115 d	$1B $73 $h	Sets spacing between all characters in proportional mode to n dots (n = 0 to 9)
ESCAPE R nnn c	27 82 ddd d	$1B $52 hhh h	Prints nnn repetitions of character c
CONTROL-H c	8 d	$08 h	Backspaces one character and prints the character c
ESCAPE X	27 88	$1B $58	Starts underlining text
ESCAPE Y	27 89	$1B $59	Stops underlining text
ESCAPE !	27 33	$1B $21	Starts boldface printing
ESCAPE "	27 34	$1B $22	Ends boldface printing
CONTROL-N	14	$0E	Begins headline mode
CONTROL-O	15	$0F	Ends headline mode
ESCAPE >	27 62	$1B $3E	Left-to-right printing only
ESCAPE <	27 60	$1B $3C	Bidirectional printing
ESCAPE A	27 65	$1B $41	6 lines per inch
ESCAPE B	27 66	$1B $42	8 lines per inch
ESCAPE I 1	27 108 49	$1B $6C $31	Enables optional line feed function
ESCAPE I 0	27 108 48	$1B $6C $30	Disables optional line feed function
ESCAPE T nn	27 84 dd	$1B $54 hh	Distance between lines to be nn/144 inch (nn = 01 to 99)
ESCAPE f	27 102	$1B $66	Forward (normal) line feeding
ESCAPE r	27 114	$1B $72	Reverse line feeding
CONTROL-_ n	31 d	$1F h	Feeds n lines of blank paper (n=1,2,3,4,5,6,7,8,9,:,;,<,=,>,?)

Code	Decimal	Hex	Effect
ESCAPE L nnn	27 76 ddd	$1B $4C hhh	Sets left margin to position nnn
CONTROL-L	12	$0C	Feeds paper to next top of form
ESCAPE v	27 118	$1B $76	Sets TOF to current position
ESCAPE O	27 79	$1B $4F	Paper error detector off
ESCAPE o	27 111	$1B $6F	Paper error detector on
ESCAPE Z @CONTROL-@	27 90 64 0	$1B $5A $40 $0	End-of-line at CR only
ESCAPE D @CONTROL-@	27 68 64 0	$1B $44 $40 $0	End-of-line at CR, VT, FF, HT, CONTROL-_
CONTROL-X	24	$18	Cancels all unprinted text
ESCAPE Z _CONTROL-@	27 90 32 0	$1B $5A $20 $0	No line feed at buffer overflow (_ = space character)
ESCAPE D _CONTROL-@	27 68 32 0	$1B $44 $20 $0	Line feed added at buffer overflow (_ = space character)
ESCAPE D CONTROL-@_	27 68 0 32	$1B $44 $00 $20	Ignores eighth bit of data byte (_=space characters)
ESCAPE Z CONTROL-@_	27 90 0 32	$1B $5A $00 $20	Recognizes eighth bit of data byte (_=space characters)
ESCAPE c	27 99	$1B $63	Restores standard instructions (Software Reset)

Tabbing Control Codes

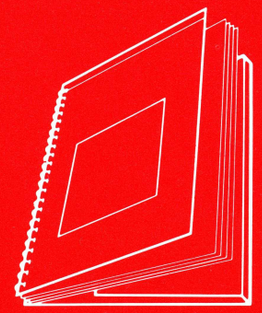
Code	Decimal	Hex	Effect
ESCAPE (a,b, ...	27 40 d1 44 d2 44 ... 46	$1B $28 h1 $2C h2 $2C ... $2E	Sets horizontal tab line (a,b,etc. = three-digit numerals)
ESCAPE u	27 117	$1B $75	Sets selected tab
CONTROL-I	9	$09	Moves type head to next tab
ESCAPE)a,b, ...	27 41 d1 44 d2 44 ... 46	$1B $29 h1 $2C h2 $2C ... $2E	Clears selected tabs (a,b,etc. = three-digit numerals)
ESCAPE 0	27 48	$1B $30	Clears all tabs
CONTROL-] A@	29 65 64	$1D $41 $40	Sets starting top of form (TOF)
C@	67 64	$43 $40	Sets bottom of form (BOF)
A@ CONTROL-	65 64 30	$41 $40 $1E	Sets TOF of next form
CONTROL-_ B	31 66	$1F $42	Drops to next tab B
CONTROL-_ C	31 67	$1F $43	Drops to next tab C
CONTROL-_ D	31 68	$1F $44	Drops to next tab D
CONTROL-_ E	31 69	$1F $45	Drops to next tab E
CONTROL-_ F	31 70	$1F $46	Drops to next tab F
CONTROL-_ A	31 65	$1F $41	Drops to next BOF or TOF
CONTROL-L	12	$0C	Drops to next TOF
GS 0	29 48	$1D $30	Sets vertical tabbing to power-on status, and sets TOF to current paper position

Custom Character Control Codes

Code	Decimal	Hex	Effect
ESCAPE -	27 45	$1B $2D	Maximum width will be 8 dots
ESCAPE +	27 43	$1B $2B	Maximum width will be 16 dots
ESCAPE I	27 73	$1B $49	Starts loading new character(s)
CONTROL-D	4	$04	Ends new character(s) loading
A.....P	65...80	$41...$50	Width code when using top 8 wires (A = 1 ... P = 16)
a.....p	97..112	$61...$70	Width code when using bottom 8 wires (a = 1 ... p = 16)
ESCAPE '	27 39	$1B $27	Switches to custom character font
ESCAPE *	27 42	$1B $2A	Switches to custom character font (high ASCII values)
ESCAPE $	27 36	$1B $24	Switches back to normal font

Graphics Control Codes

Code	Decimal	Hex	Effect
ESCAPE G nnnn	27 71 dddd	$1B $47 hhhh	Prints graphics columns corresponding to the following nnnn data bytes
ESCAPE S nnnn	27 83 dddd	$1B $53 hhhh	Same as ESCAPE G
ESCAPE g nnn	27 103 ddd	$1B $67 hhh	Prints line corresponding to the following nnn x 8 data bytes
ESCAPE V nnnn c	27 86 dddd d	$1B $56 hhhh h	Prints nnnn repetitions of the dot column specified by c
ESCAPE F nnnn	27 70 dddd	$1B $46 hhhh	Places succeeding printing nnnn dot positions from left margin



Tuck end flap
inside back cover
when using manual.

Apple IIc Imagewriter User's Manual

The Apple IIc

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